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The New Safety Regulations

WITH more than half a century's experience in the distribution of electricity, there ought to be little difficulty in drawing up a set of regulations for securing a safe and reliable supply to the public. It is less easy, however, to make them fit existing conditions. If they were designed for retrospective application immediately, they would need to be a compromise between what is practicable, having regard to expenditure and interference with consumers, and what engineering opinion would regard as an adequate modern standard.

In issuing, three years ago, a consolidated code to supersede the regulations originally made by the Board of Trade in 1909, the Electricity Commissioners evidently attached more importance to ensuring a sound standard for the future. They confined the scope of the new code for the time being to works constructed or supplies given after January 15th, 1934, allowing a breathing-space for those already in existence. Since that date the views of those concerned in the supply of electricity have been obtained, and a revised set of regulations, to come into force in the New Year, has been issued.

The 1937 Supply Regulations are more than a drafting improvement on the earlier edition and incorporate notable modifications to which we draw attention in an article this week. They are divisible, roughly, into two groups—those relating to lines and works of undertakings and those relating to consumers' installations and supplies.

Probably the most important feature of this document is that it defines the position of existing works and supplies, which are accorded entire exemption not only in regard to requirements the fulfilment of which is impracticable at this date (such as the testing of cables *in situ* before jointing), but also in other important respects. Thus, three-phase supplies given to domestic installations of 8 kW or less need not be changed to single-phase, this figure itself being a substantial reduction from the 15 kW of the 1934 Regulations.

General exemption for two years (but no longer) is given in regard to outdoor sub-stations, street boxes and service entries, among other things. Neon signs are also in the postponed category, but Regulation 31 tightens up the corresponding provisions in the earlier code. Here the procedure adopted in many of the other sections has not been followed of regarding observance of the I.E.E. Wiring Regulations as meeting all requirements (which does not make them "compulsory," as is sometimes supposed), as other matters have to be taken into account.

The increase in the variation of voltage from that declared at consumers' terminals to ±6 per cent. permitted for new supplies in 1934 is now allowed in all cases, but the frequency tolerance has been reduced from 2½ to 1 per cent., presumably as a result of interconnection of power stations.

Conditions under which an undertaking may refuse to supply have also been made more explicit; one of these is when single-pole switches are not inserted in live conductors. Qualifications introduced when the safety of old installations is under consideration should, however, be noted, as some latitude is granted to the consumer in such cases.

So far as can be seen at the moment the 1937 Supply Regulations can be generally adopted without much difficulty. There may be particular cases of hardship, but hard cases make bad law for universal application. The Commissioners have, however, the right to vary any of the Regulations to suit individual instances, and presumably this will be done when due cause is shown.

Safe and Happy

WITHOUT desiring to add a sinister note to the Christmas festivities, the National "Safety First" Association and the National Fire Brigades Association have issued a warning against the perils which lurk in the background. Among the "don'ts" in a rather formidable list is a caution against the use of naked lights on Christmas trees. We may again say, in this connection, that there is even greater danger in the use of flimsy strings of small electric lamps. It is advised that an electrician should be called in to make contemplated changes in electrical wiring. This is a sound suggestion, as are the others that portable fires should be kept well out of the way and decorations hung clear of lights and fuse-boards. These and the others are simple common-sense rules which, if observed, should ensure a safe, as well as happy, Christmas.

Collieries and Factories

DISCUSSIONS of the annual report of the Electrical Inspector of Mines have become annual events for some branches of the Association of Mining Electrical Engineers, Mr. J. A. B. Horsley being present on such occasions to explain his views and, no doubt, to profit by expressions of opinion by men whose co-operation is necessary in the interests of safety. A similar contact with his co-workers to the same end has been established also by Mr. H. W. Swann, Chief Electrical Inspector of Factories, whose report for 1935 on "Electrical Accidents" was discussed at a recent joint meeting at Cardiff of the I.E.E. Western Centre and the E.P.E.A. It is to be hoped that the keen interest displayed in these two topical and practical reports will lead to their being debated in many other areas.

The Force of Example

How wearisome are the repetitions of individual expressions of appreciation of a paper with which those who contribute to the subsequent discussion so often open their remarks. Members of the I.E.E. owe much to Mr. J. M. Kennedy, last year's president, for introducing a procedure (adopted also by Mr. H. T. Young this session) by which the vote of thanks to the author is moved from the chair immediately on conclusion of the reading of the paper, coupled with the request that later speakers shall confine their attention to comments on the subject-matter. A similar precedent was established at a recent meeting of the Illuminating Engineering Society. Other technical societies, please copy. The I.E.S. is also economising time by the installation of "traffic lights," in which an amber warning is followed by a red "stop." This system, to be perfect, should act qualitatively as well as quantitatively, the former being understood to include audible delivery.

Kearsley Power Station

THE group summary of generating stations given in the Electricity Commissioners' Fuel Returns shows that the consumption of coal per kWh varies inversely with output on the average. This is not a matter of size alone, since station load factors, and more especially plant load factors, have an important bearing on results and preference in running is given to the more economical plant on interconnected systems. Anticipations of improved overall figures as a result of the 51,000-kW extension at Kearsley rest chiefly on the adoption of steam conditions for the new boilers that are comparable with those that have brought Battersea, Barking B and Dunston B to the head of the list. Thermal efficiencies achieved by stations constructed in recent years have been closely related to individual steam conditions, with only a few coming out of their order. Kearsley has been one of these variants, as with 305 lb. per sq. in. boiler pressure for the original plant it comes in front of all those under 400 lb. and two above the figure. With this should be compared the consistently good performance put up by Padiham—another station of the Lancashire Electric Power Co. of over 20 per cent. with a 250-lb. boiler pressure.

Charging on Averages

IN his A.S.E.E. paper on domestic load and tariffs last week, Mr. F. W. Purse made a plea for the compulsory adoption of a two-part tariff based on the size of the house, mainly, it seems, because that tariff presents to him the best conception of basic averages. Averaging production costs in a supply charge appears to us a practical and logical thing to do, particularly in view of the necessity of presenting something easily understood by the consumer. But with our mind strictly on "those basic averages" we cannot see the logical *ultimate* conclusion in a two-part tariff. Instead, we should say that averaging would be given final expression in just one charge per unit sold. Such a fulfilment of the basic averages idea, of course, would not induce business, but without any desire to take sides we can point to some of the highly successful sliding-scale charges in this country which appears to represent a nearer approach to the academically logical conclusion in averaging all costs than does any of the forms of two-part tariff mentioned by Mr. Purse.

Intermittent Space Heating

IN another part of this paper Mr. Purse repeated an old warning against attractive long-period hire-purchase terms for electric fires, in that they might be installed too freely and used only for emergency cold snaps with unsatisfactory financial results. The electric fire is used mainly for convenience or intermittent heating, not because of any easy means of purchase, but because high-temperature electric heating is generally too expensive for whole-time use. The electric fire has a very high convenience value for short-time use; but in view of the fact that there are ways and means of space heating electrically on a competitive basis, this occasional use, to take the really long view, is much more undesirable than the aspect presented in the paper.

Paying Out in America

WHAT at the first glance looks like a boom in the American electrical industry is reported from the United States. Many of the leading electrical manufacturing concerns and power companies are raising their dividends and giving their employés bonuses and increased salaries. Closer investigation reveals, however, that while there is no doubt that these companies are doing very well, their extra disbursements are not due entirely to that. The provisions of the United States Revenue Act include the taxation of undistributed earnings, and, accordingly, with the usual reluctance of the good citizen to pay more to the national exchequer than he can help, these undistributed earnings are being reduced so far as is consistent with sound finance. The stockholders and employés will, no doubt, give full support to this policy.

The Common Cold

THE view that the amount of CO_2 in the air of a building provides a measure of the injurious impurities in it is a common fallacy. Dr. J. S. Owens, in a paper read before the Institution of Mechanical Engineers, says that there is no doubt that colds supposed to be caused by going out of a warm place of assembly into the cold air are contracted inside. Infectious diseases are, he states, transmitted by particulate matter that passes filters, and dilution with air from outside provides the best means of purifying air. This would appear to entail the use of larger electric fans with air-conditioning plants and more frequent changes of air in a building than are often found to-day. It may be added that the effect of merely imparting motion to the air would presumably enable the respiratory capacity of the skin to help in resisting the onslaught of germs.

Electricity in Printing

A large new works at Park Royal

THE new works of Waterlow & Sons, Ltd., at Park Royal, Harlesden, Middlesex, which were opened on December 21st, provide a notable example of the manner in which electricity can be used to facilitate the production of printed matter on a large scale.

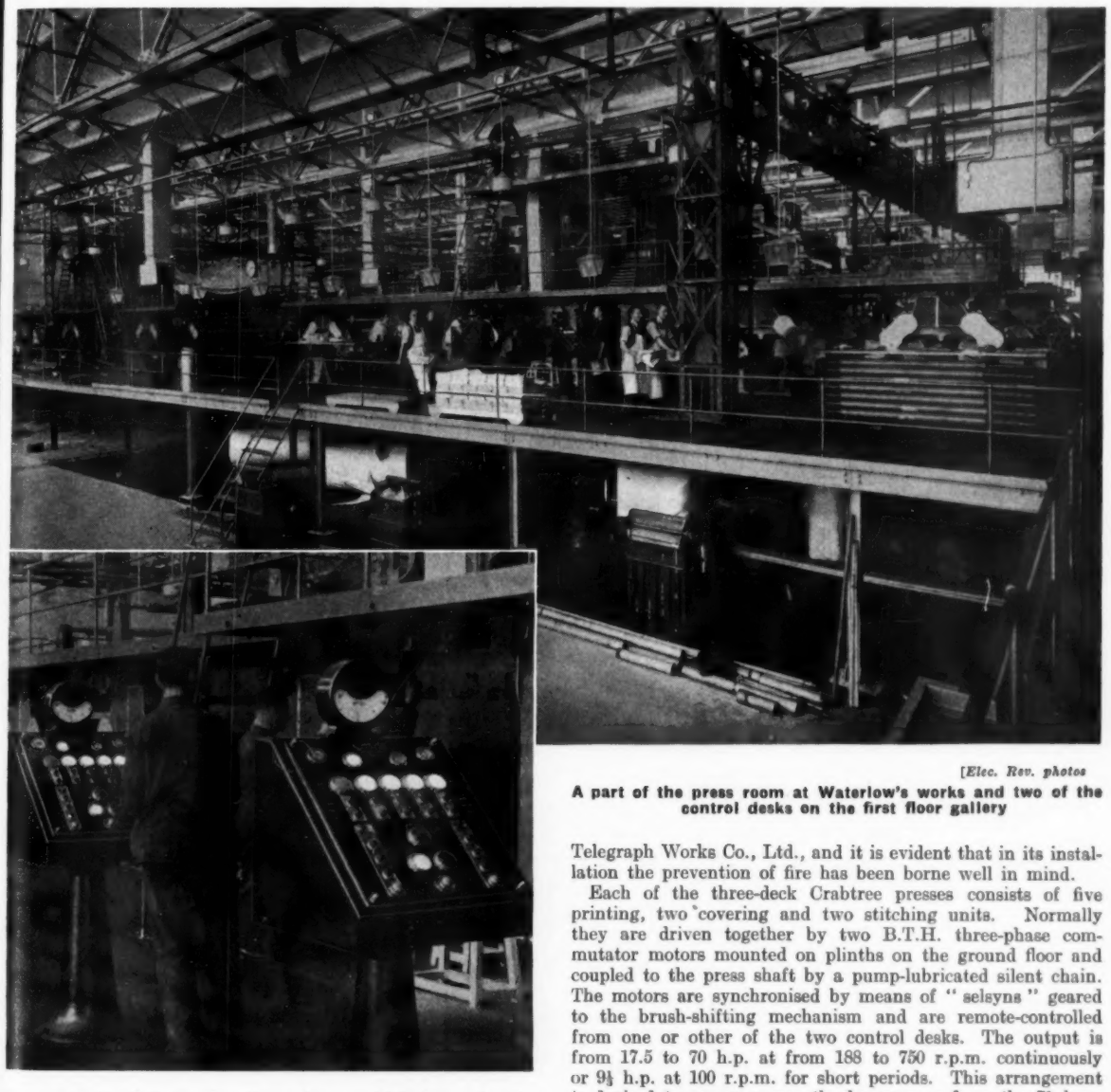
A supply is taken at 6.6 kV from the mains of the Metropolitan Electric Supply Co., through a "Metesco" ring-breaker embodying two oil-immersed isolators for the loop-in and a circuit-breaker for the service tee. The latter is connected to two Crompton-Parkinson 150,000-kVA truck-type circuit-breakers, each controlling a 1,000-kVA transformer, made by the same company, stepping down to 400-230 V. The 60,000-kVA low-voltage circuit-breakers, to which the transformers are connected by lead-covered cables cleated to the sides of a trench, are similarly of the truck type and are interlocked with the corresponding 6.6-kV switches, so that tripping on one side of the system involves isolation on the other.

On the opposite side of the sub-station is a Kartret feeder switchboard to which current is taken, *via* a summation panel, passing to the left to nine three-phase cubicle-type circuit-breakers for power and to the right to twelve single-phase switch and fuse units for lighting.

There is a separate 0.2-sq. in. feeder (with 0.05-sq. in. neutral) for each of the six presses at present installed and three of 0.15 sq. in. for the heating and ventilation plant and other auxiliaries. Accommodation is available in the sub-station for a third transformer and further switchgear, including that required for serving four more presses to be laid down later.

The outgoing cables are paper-insulated single-wire-armoured running in concrete ducts to a central control switchboard manufactured by Meech Electric Drives, Ltd. As each press is driven by two motors, this switchboard comprises six double panels, to which are fitted air-break overload switches and the large number of contactors associated with starting up, shutting down and speed control, which are operated from desks adjacent to the machinery. The main switches have a "test" position as well as "off" and "on" positions, enabling correct operation of the controls to be checked without running the motors.

Single-wire-armoured power cables to the two driving motors are taken in ducts by different routes. Multi-core control cables, also single-wire-armoured, are run in metal casing from 31-way glanding boxes under the control board, two ways of which are allocated to the power cables. In all, about seven miles of armoured cable has been used, involving the use of fifty-three miles of conductors, since some of the control cables are seven-pair. There are also 2,000 yd. of v.i.r. connections in steel conduits between each press and control panels. The cable has been supplied by W. T. Henley's Telegraph Works Co., Ltd., and it is evident that in its installation the prevention of fire has been borne well in mind.



[*Elec. Rev. photos*

A part of the press room at Waterlow's works and two of the control desks on the first floor gallery

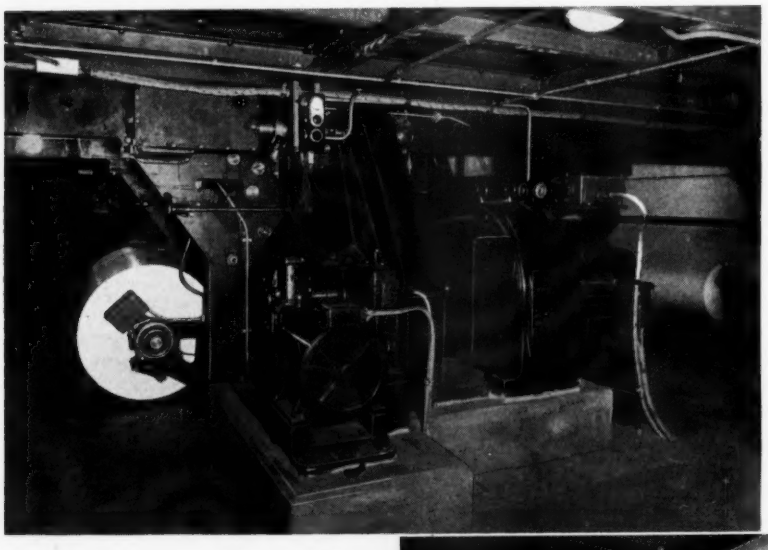
Each of the three-deck Crabtree presses consists of five printing, two covering and two stitching units. Normally they are driven together by two B.T.H. three-phase commutator motors mounted on plinths on the ground floor and coupled to the press shaft by a pump-lubricated silent chain. The motors are synchronised by means of "selsyns" geared to the brush-shifting mechanism and are remote-controlled from one or other of the two control desks. The output is from 17.5 to 70 h.p. at from 188 to 750 r.p.m. continuously or 9½ h.p. at 100 r.p.m. for short periods. This arrangement is devised to secure a smooth change over from the 7½ h.p., 720 r.p.m. B.T.H. squirrel-cage barring motor employed for starting up and making ready, thus obviating any tendency to snatch or undue tensioning of the web. Alternatively, any press may be run as two separate machines turning out different kinds of matter. A smooth electro-magnetic braking system automatically brings the press to rest when the power is cut off.

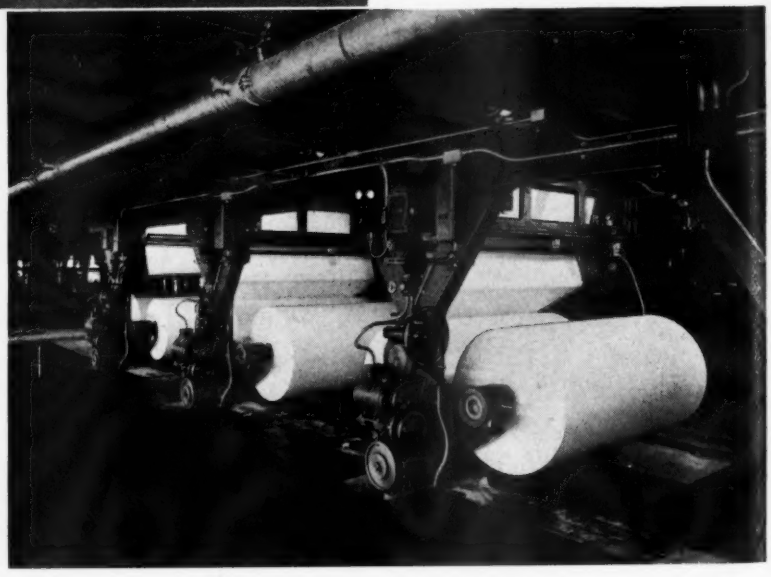
The pedestal control desks on the first-floor gallery are an essential feature of the Meech driving system. In addition to the push-buttons controlling inching and speed raising and

lowering, the panel includes a means for varying the side-lay of the paper on receipt of an indication that the margin requires adjustment. A 2-h.p., 1,440-r.p.m. induction motor for effecting this alteration is installed for each unit, and coloured lights indicate the conditions to the reel men. On the desk, also, is an amber light advising the operator that the attendant on the ground floor has reduced speed in order to insert a new paper reel. This speed reduction is accomplished by locking open a switch in a local pilot circuit included in the same box as the inching button, but on a separate line.

If a web should break, the removal of the tension from a pawl instantly closes a switch on the end of the shaft involved, energising an electro-magnet which causes the broken end of the paper to be gripped and the reel for the unit to be held, a signal being transmitted to the control desk. Members of the crew are kept in constant touch by visible signals, and an audible signal (different for each press) gives warning when it is to be started up. Main and unit clutches on the press select the required combination by automatically placing the electrical control circuits in correct grouping, thus eliminating the necessity for hand switching. At twenty-five points on each press are emergency buttons, by means of which the machine can be stopped at once in case of accident.

It is anticipated that about 24,000 stitched and bound copies of the *Radio Times* and *World Radio* will be turned out per hour by each press. These are placed in the buckets of one of the four elevator conveyors driven by 6-h.p. motors and thence on to a roundabout roller conveyor running at 80 ft. per minute (North Acton Conveyor Co.), from which the journals are taken into bays corresponding with geographical districts before being sent out to the despatch department on two roller runways operated by a 1½-h.p. motor for the straight section of each and a 2-h.p. motor for the inclined section, the two machines being interlocked electrically to prevent banking up of the papers should one motor stop.



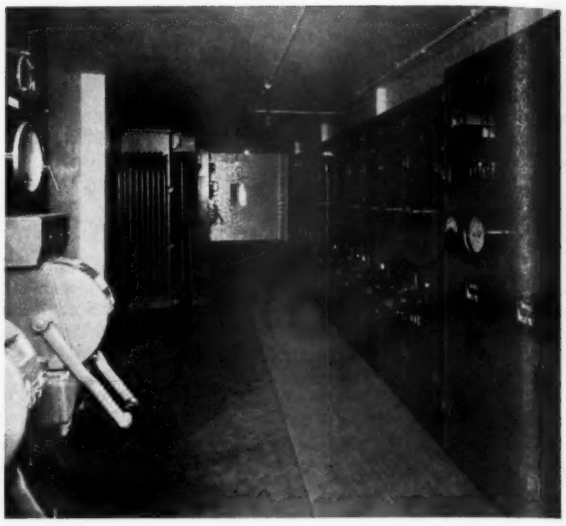


[*Elec. Rev.* photos.

Above: Main driving and barring motors. Right: Paper reels, showing motors for margin adjustment

Air for ventilating the press room is drawn from the outside of the building by a 10-h.p. fan (the B.T.H. driving motor for which has a speed range of from 1,000 to 1,400 r.p.m.) and admitted through fourteen funnels aloft in which are small hot-water systems and fans driven by ¼-h.p. Meech Electric condenser-type motors controlled from three points. The foundry is ventilated by a 4-h.p. fan.

Printing ink is made in a plant driven by a Laurence, Scott 35-h.p., 970-r.p.m. motor controlled by Allen West gear, and falls by gravity into storage tanks, whence it is taken to the mixers driven by 1½-h.p. Brook motors. It is then circulated continuously round the presses by two 3-h.p. B.T.H. motor-driven pumps, enough for the purpose of each roller being drawn by a foot valve into local reservoirs.

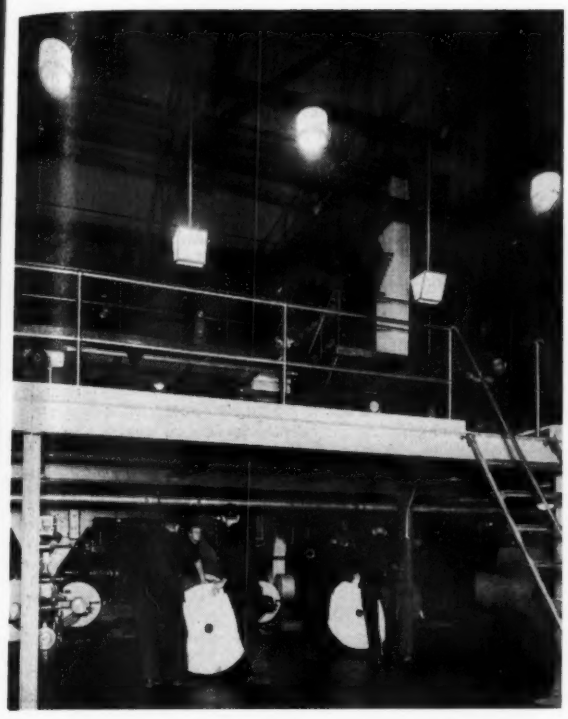


[*Elec. Rev.* photo

A view of the sub-station

In the composing department are eight Intertype machines driven by ¼-h.p. Metrovick s.p. motors. The metal is heated in pots taking up to 12 A, with G.E.C. temperature-control resistances. Four more of these machines are to be installed later. Two Ludlow slug-casting machines for 18- and 36-point type are driven by ¼-h.p. B.T.H. s.p. motors, and the 4-kW metal heaters are fitted with five-point control. Another application of heat is to the two "Hydroforme" matrix presses, for which 38 kW is required; these machines are driven by 7.5-h.p. Fuller motors.

The scheme of illumination, designed by Holophane, Ltd., is based on the use of mercury-vapour discharge lamps in view of the high definition their light gives on black and white processes. The use of fittings over the machines was not regarded as permissible, and so central-aisle lighting has been adopted. On the first-floor gallery the lighting units are mounted at 13 ft. 6 in. to provide general illumination and at 7 ft. for the cylinders, the latter height being chosen to avoid obstruction due to the upper galleries. In the first case, a clear prismatic reflector fitting has been adopted with opalescent cylinder and bottom convex glass enclosure for use with twelve 150-W discharge lamps; in the second, the width of the aisles necessitated the use of fourteen directional lanterns per press, each embodying two concentrating refractor panels and sides and base of



[*Elec. Rev. photo*

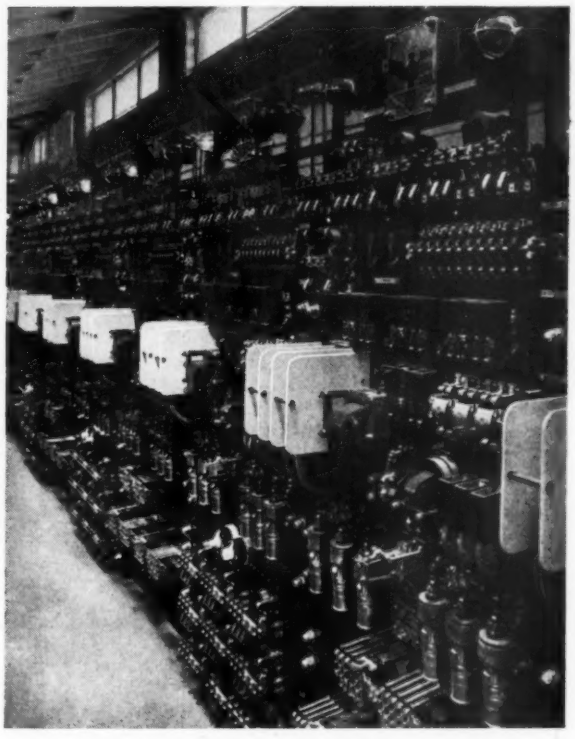
The ground and first floors of a press at night

flashed opal glass. These are to contain 75-W discharge lamps as soon as they become generally available in that size. Illuminating intensity of this gallery averages from 11 to 12-ft.-candles.

For lighting the ground floor, general aisle lighting has again been provided, employing the new circular Holophane bulkhead fitting, supplemented by "Widerlite" units along each side of the presses to facilitate the placing in position of reel spindles. Two 60-W gasfilled lamps are installed between rolls and six between units.

Discharge lamps have been used in such positions as those required for outside lighting, the reel store (sixteen points), packing room (forty-two), compositors' department (thirty-four), and type foundry (nine) in conjunction with Holophane reflector diffusing fittings appropriate to the needs of each case. From 13 to 15 ft.-candles is reached in the foundry and nearly 22 in the composing room.

The economy that may be effected in energy by the use of electric discharge lamps is not always the greatest of their advantages, though much depends upon the ability of designers of lanterns and fittings to exploit fully advances made in lamp manufacture. This installation provides an addition to the number of those now in industrial service that prove the value of good lighting when mercury-vapour lamps are employed in conjunction with appropriate accessories.



The main control board [*Elec. Rev. photo*

Indeed, taking the installations as a whole—power, heating and lighting—with the elaborate system of duplicate control of the presses, an observer may be tempted to express the heterodox view that having regard to what electricity makes possible, its cost appears to be a minor consideration.

Lighting circuits are controlled by 15-A "Wandsworth" foot-press switches and are fed from Kartret distribution boards and Simplex sub-circuit boards. The installation work for both power and lighting systems was carried out by Messrs. Bell Bros. & Co. (London), Ltd.

[*Elec. Rev. photo*

Showing some of the lighting of the works which is by mercury-vapour discharge lamps

The New Electricity Supply Regulations

To come into force on January 1st

FOR securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy, a revised set of Electricity Supply Regulations has been issued by the Electricity Commissioners (Stationery Office, 6d.). These are to come into force on January 1st, 1937, and supersede all previous regulations (apart from the Overhead Lines Regulations), including those of 1934, but certain exceptions are made in respect of works constructed or supplies given before the prescribed date. The principal variations from the 1934 edition are stated below :—

Electric lines at low and medium voltages (up to 250 and 650 V) and apparatus, also at high voltages (above 650 V) must now be tested after being placed in position but before jointing or connection to a live system, even if tested previously. Low- and medium-voltage, but not high-voltage, lines and cables above ground are excluded from this (1 and 6).

On d.c. three-wire systems the maximum resistance in parallel with the earthing fuse or circuit-breaker has been increased from one ohm to five ohms. For the remote control of switches on a.c. systems the secondary winding of a h.f. transformer of not more than 2,000 microhms and 10 microhenries may be inserted in the earth connection (4).

Low- and medium-voltage a.c. systems which are earthed at one point may be electrically connected if each earth connection is bonded to the sheathing and armouring of the lines concerned, and, if overhead, the neutral is of the same material and size as the corresponding phase conductors. A system including a generator or transformer not having a mesh winding of low impedance shall not be connected with another if the neutral point of the generator or transformer is earthed (4).

Electrode Boilers

An electrode boiler (connected with earth) supplied at low or medium a.c. voltage shall have its metal connected to the sheath and armouring (if any) of the supply line. No other earthing points are permitted without the consent of the Commissioners and the Postmaster-General, who requires notice in other cases of earthing also (4). Supply to an electrode boiler at high voltage is subject to the same condition as at low and medium voltages, but has to be controlled by an automatic circuit-breaker set to operate with a phase unbalance of 10 per cent. of the rated current or a maximum of 15 per cent. where essential to ensure stable operation. To prevent tripping out with momentary unbalanced phase currents inverse time element devices may be used.

Where a high-voltage supply is given, arrangements may now be made between the undertaking and the consumer for the control by the latter of the service lines on his premises (5). High-voltage systems, each earthed at one point, may not be interconnected without the approval of the Commissioners and the P.M.G. (8).

The paragraphs relating to consumers' installations contain an addition which excuses an undertaking from commencing or continuing to give a supply unless all single-pole switches are inserted in live conductors only (27). A supply at low voltage from more than one pair of conductors of a three-wire or multi-phase system is prohibited if the apparatus connected or intended to be connected exceeds 8 kW (in the 1934 Regulations the figure was 15 kW) and then only if this is necessary to avoid a variation of voltage in excess of the permitted margin (see 34). Supply may be refused unless the socket outlets in any room are connected to the same pair of conductors; this provision is substituted for the three stipulated in the 1934 code (28).

A new condition for high-voltage supplies is that the consumer shall guarantee in writing that, where the installation is not enclosed in a building or other structure to which access can be obtained by a key or special appliance, an authorised person will be available to cut off the supply in emergency. This is in addition to the written guarantees now required that every portion of the installation shall be maintained efficiently to the satisfaction of the undertaking and that an instruction card as to the treatment of persons suffering from electric shock shall be affixed in the premises (30).

Luminous-tube Signs

The permission given under the 1934 Regulations to refuse supply for transformation to high voltage for a luminous-tube sign on the outside of a premises that does not comply with the requirements has become a prohibition and applies to the continuance of the supply as well as its commencement with the qualification of "knowingly." The consumer must give a written guarantee that the existing conditions as to low-voltage isolation of the transformer within and without the building, mechanical protection and earthing have been fulfilled, and in addition that there is a 3-in. space between the outside of the metal enclosures of high-voltage conductors and any electric line (not part of the installation) or any pipe.

Means must be provided to prevent any unauthorised person coming into contact with (instead of having access to as at present) high-voltage parts of a luminous-tube installation and a danger notice must be displayed at points of access. A written guarantee that the installation complies with the I.E.E. Regulations is regarded as fulfilling requirements save in so far as the Commissioners' Regulation specifies further precautions (31).

A definition of what constitutes "proper order and condition" of an installation is now given by references in Regulation 32 ("Discontinuance of Supply") to Regulations 26 to 31. The first of these is the old rule limiting leakage current to one ten-thousandth part of the maximum current to be supplied to the installation, and the three following it relate to size of conductors, switches and fuses, to low-voltage supplies from more than one pair of conductors, to the earthing and mechanical protection and electrical control of medium-voltage installations, to high-voltage supplies and to luminous-tube signs.

Satisfactory Existing Installations

Non-fulfilment of the provisions of these conditions (beyond that regarding leakage) does not entitle an undertaking to decline to connect or reconnect an installation which was supplied with energy before January 1st, 1937. In case of dispute an inspector appointed by the Commissioners would not support such action by an undertaking if the installation had continued to function satisfactorily up to the material time, and might be expected to continue to do so without risk, and that it was used only within the limits of the maximum power for which it was originally intended (33).

The permissible variation of frequency from the declared figure is now one (instead of 2½) per cent. and of voltage plus or minus 6 per cent., as in the 1934 Regulations. This now becomes applicable to all supplies and not only to new ones. The 12½ per cent. increase allowed above the minimum declared for supplies for the time being given at high voltage, omitted from the 1934 edition, has been restored (34).

No "change of the neutral conductor" is permitted without the consent of the Commissioners (the former reference to "without change of polarity" for d.c. has been omitted). Disconnection of supply is now allowed when an emergency is liable to affect the proper working of another undertaking from which a direct or indirect bulk supply is received (35). Undertakings are now required to notify the Commissioners of any electrical fatality on the premises of any ordinary consumer, *i.e.*, generally those not covered by Home Office or Mines Department Regulations.

A Number of Exemptions

Many of the new Regulations will, by their nature, not apply to existing works and supplies, though they will apply to reconnections. These include Nos. 1 to 6, which relate to the testing of lines and apparatus before use and to general permission as regards new applications for which special consents were previously required. The same reasoning excludes the need under No. 12 for the standard of construction of lines (including services) to be as good as that prescribed in the appropriate B.S.S.

In addition to these, in existing supplies a fuse or circuit-breaker may be retained in an earth conductor of a service, and high-voltage service fuses or breakers need not have isolators also. Nor need undertakings bring old installations owned by them up to the same standard as they now require their consumers to adopt. Existing low-voltage three-phase supplies of less than 8 kW installed (28) may be continued. Provisions of No. 30 as to inaccessibility of high-voltage apparatus on consumers' premises and the obtaining of a written guarantee for each high-voltage consumer regarding the operation and maintenance of his installation apply only to new connections.

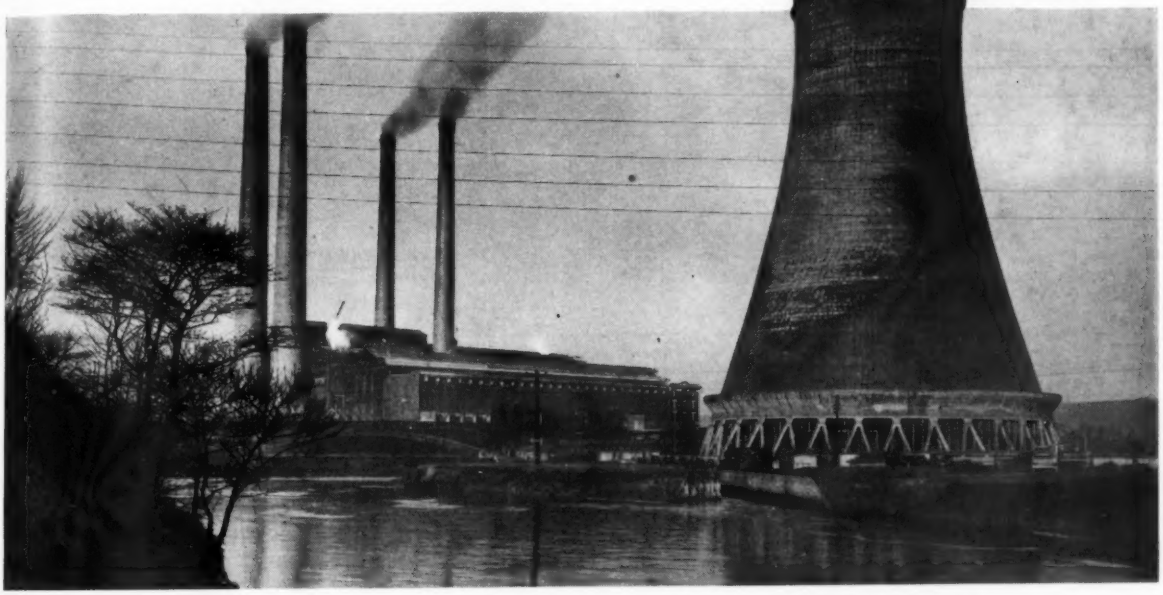
A time limit of two years is allowed for bringing existing works and supplies into conformity with certain of the new Regulations. These include the requirements in No. 9 (ii) and (iii) regarding the fencing of outdoor sub-stations and the separation of transformers from switches and fuses in underground street boxes (other than sub-stations), and in No. 10 (6) regarding constructional details of supports for high-voltage lines and positions adjacent thereto, and the restrictions on the storage of oil in 16 (6).

Similar temporary exemptions are also made in the case of No. 19 relating to street boxes (segregation of cables and precautions against gas), of Nos. 22 (entry of service lines), 23 (identification of conductors in service lines), and 31 (luminous-tube signs).

The Kearsley Extensions

A new 51,000-kW turbo-alternator set; higher steam conditions for new boilers

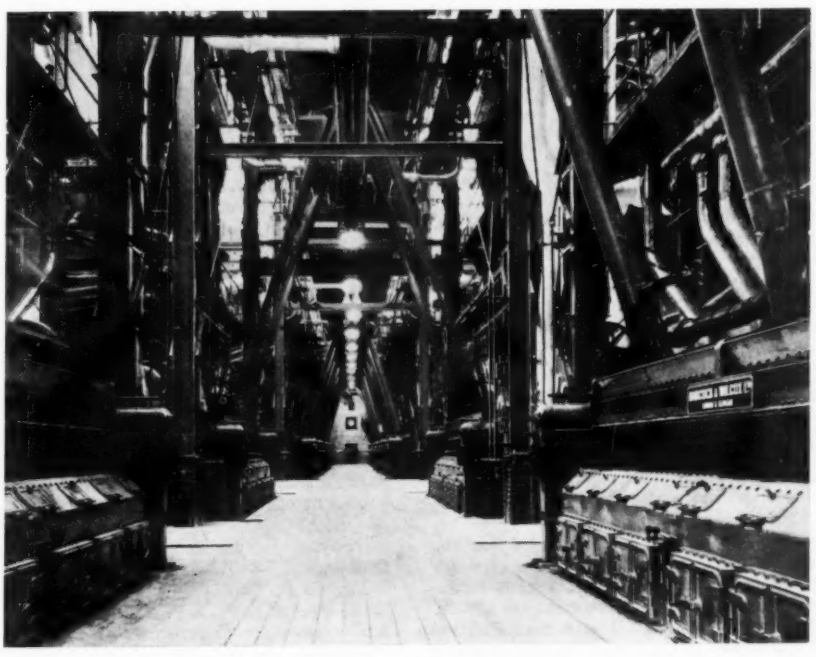
AN important development of the Lancashire Electric Power Co. was marked on Monday this week when the Rt. Hon. the Earl of Derby, K.G., officially inaugurated extensions to the company's Kearsley power station. The station was put into commission in October, 1929, with an initial plant capacity of eight 75,000-lb. per hour boilers and two 32,000-kW turbo-alternators, and in the description of it in the ELECTRICAL REVIEW of July 31st, 1931, we were able to point to the notable operating results of highest overall thermal efficiency and lowest fuel consumption for the year 1930 of any of the steam stations covered by the Electricity Commissioners' Returns. The figures were :—Efficiency 23.84 per cent. and fuel consumption per kWh generated 1.173 lb. Simplicity of plant, a minimum of auxiliaries, uniformity of boiler firing with hand control and the use of high-grade fuel, 12,200 gross B.th.u. per lb. as fired, were given as the outstanding features of the station.



A view of Kearsley from the weir. The cooling tower is said to be the largest of its kind

Under rather widely varying loading conditions these operating results have been consistently maintained during the subsequent years. In 1930 the energy generated at the station amounted to 129.6 million kWh and the station load factor was 42.28 per cent. For 1933, when 207.7 million kWh was generated and the load factor was 47.9 per cent., the efficiency and fuel consumption were 23.62 per cent. and 1.18 lb., respectively. For 1934 and 1935 the respective figures were: efficiency 23.70 per cent. and 23.95 per cent., fuel consumption 1.18 lb. and 1.17 lb., generation 278.6 millions and 401.9 millions, load factor 55.6 per cent. and 75.5 per cent.

No longer, however, do these maintained figures rank quite so high in the Commissioners' list, and nowadays efficiency figures much nearer the 30 per cent. mark are appearing, with figures nearer or below 1 lb. per kWh for fuel consumption. For instance, for the year 1935 the list was headed by the new Battersea power station with the highest thermal efficiency of 28.59 per cent. and the lowest fuel consumption of 0.96 lb. The principal reason why efficiency of the leading stations has shown such a remarkable advance is no doubt the fact that the stations represented are those which have adopted improved steam conditions and this view is evidently supported at Kearsley where 620 lb. per sq. in. and 850 deg. F. have been adopted as the new boiler steaming conditions. It is said that the new conditions will have the effect of improving the efficiency of generation by approximately 16 per cent., so that with the new plant we may expect to see an operating figure for Kearsley in the future of, say, 28 per cent. thermal efficiency.



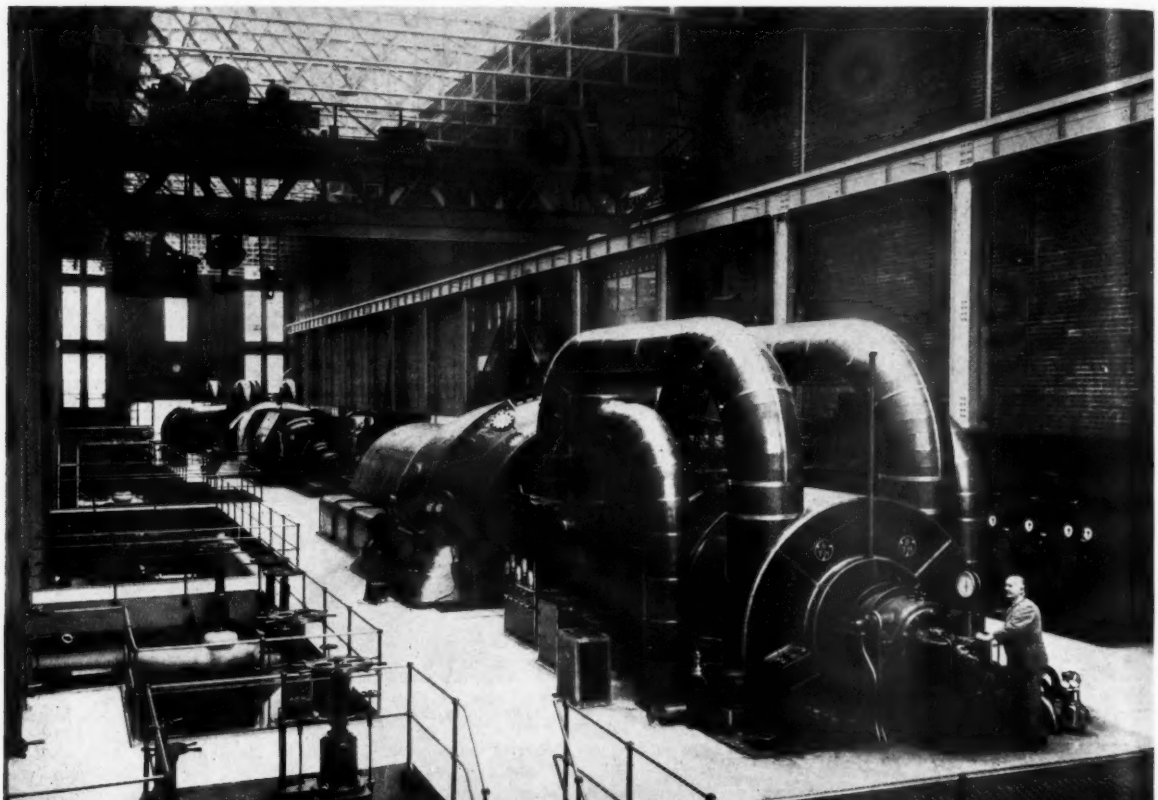
The firing aisle of the boiler house

In 1934 the capacity of each of the initial boilers was increased to 95,000 lb. per hour by the installation of water-cooled furnaces, and these remodelled furnaces now constitute a 60,000-kW steaming installation, operating under the conditions for which the station was initially designed, namely, 320 lb. per sq. in. and 700 deg. F. The station was actually designed for an ultimate capacity of sixteen 75,000-lb. per hour boilers.

There are four new boilers, produced by Babcock & Wilcox, Ltd. Each has a maximum rating of 173,000 lb. of steam per hour and three of them are suffi-

cient to give the maximum output from the turbine, the fourth boiler being a spare unit. They are fitted with water-cooled walls of the Bailey type and travelling chain-grate stokers, also supplied by Babcock & Wilcox. The stokers are 25 ft. wide and 20 ft. long, so that under each boiler there is a grate area of 500 sq. ft.

Foster economisers and B. & W. tubular air heaters are installed with each boiler, the final temperature of the outlet gases being in the neighbourhood of 230 deg. F. Each of the two main fan units installed with each boiler consists of a two-speed motor driving through a hydraulic coupling



The turbine house with the new 51,600-kW set in the foreground

forced- and induced-draught fans on the same shaft. The fan installation was supplied by Davidson & Co., Ltd.

The existing station coal- and ash-handling plants have been extended to meet the additional requirements of the new boilers. Rail-borne coal is tippler discharged to receiving hoppers and bucket-conveyor fed to the boiler bunkers. The new ash-handling plant embraces the B. & W. special arrangement of water paddles.

The station was designed with a view to the ultimate installation of four turbo-alternators all of the same capacity (32,000 kW), but because of the requirements of the Central Electricity Board provision has now been made for a capacity increase of the third and fourth sets, and it is the first of these which constitutes the generating-plant component of the present extension.

This new machine, which was built by the British Thomson-Houston Co., Ltd., has a capacity of 51,600 kW. It is of the two-cylinder type, with a single exhaust opening and a single condenser supplied by Worthington-Simpson, Ltd. The speed is 1,500 r.p.m. The generator is wound for 33,000 V and is believed to be the largest machine in the country generating at this voltage. It was designed for a power factor of 70 per cent., the kVA output being 71,400. The auxiliaries installed in connection with this machine are electrically driven and supplied partly from a small house alternator on the same shaft as the main alternator and partly from auxiliary transformers connected to the main bus-bars.

A single cooling tower which has been installed for the new set is capable of dealing with 3,370,000 gallons of water per hour and is claimed to be the largest of its kind in the world. Its height is 260 ft. and the base diameter 175 ft. The tower was constructed by Fred Mitchell & Son, Ltd., to the design of L. G. Mouchel & Partners, Ltd. The tower for the next set will be similar in all respects to the one already erected. The condenser circulating pumps for the new plant are situated in a pump house near the tower on the opposite side of the river to the power station, and the pumps are so arranged that the river water, or, alternatively, the tower system, can be used for condensing purposes. There are two pumps to each set, each capable of carrying 60 per cent. of the full load of the turbine.

It will be recalled that the station is situated in the southern and more populous part of the undertaking's area, near the old village of Ringley and on the banks of the River Irwell, not far from the company's original power station at Radcliffe, which, incidentally, was officially opened by the late Lord Derby in October, 1905.

The Opening Ceremony

At the inauguration ceremony, when he unveiled a suitably inscribed tablet, Lord Derby referred to the opening of the original L.E.P. power station by his father, records of whose speech (reported in the ELECTRICAL REVIEW of October 13th, 1905) revealed a somewhat prophetic vision as to the future use of electricity. But he did not think that the late Lord Derby could have foreseen the enormous extent to which the commodity is being used to-day.

At a celebration luncheon in Manchester Mr. G. Balfour, J.P., chairman of the company, said that the present extension represented just about thirty-one times the capacity of the original station. Sir John Brook said that the typical spirit of Lancashire—efficiency coupled with geniality—was embodied in the L.E.P.. Sir J. Nall, D.S.O., who joined the L.E.P. board less than a year ago, said he had found that this supply company did not lag behind the rest of the country. He wanted to see the general productivity of Lancashire increased with the load at Kearsley.

The Lord Mayor of Manchester, Alderman Joseph Toole, said that this country had taught the whole world how to be proficient engineers. In a reference to the McGowan Report, Mr. R. A. Carey, M.P., said that the benefits enjoyed by some by way of cheaper electricity must be extended to the whole country.

Mr. C. D. Tait, engineer and manager, spoke of the two main aims of the L.E.P. staff: to render service to consumers and to give proper returns to the shareholders who supplied them with the necessary means of development. This year he would have completed thirty years' with the company.

Live-line Testing.

By J. S. Forrest, M.A., B.Sc.

A method of proving high-voltage insulators

IN the operation of overhead high-voltage lines it is generally recognised that some measure should be adopted to ensure that the insulators are replaced before they deteriorate to a dangerous extent. Little definite information is available on the rate of deterioration, but it seems that with modern insulators the rate due to ageing is very small—a fraction of one per cent. per year. On the other hand, if some slight manufacturing defect is present the rate may be much higher, perhaps several per cent. per year. Deterioration usually takes the form of a puncture through the head of the insulator and a multi-unit string may contain several punctured units without showing any external signs of deterioration. If the insulator string is left in service in this condition further punctures may occur in the remaining units until the string breaks down at the line voltage. When breakdown occurs the power arc does not take the form of an external flashover, such as is produced by lightning or fog, but follows the puncture paths within the insulators, thus shattering the porcelain and hardware, and allowing the conductor to fall. It is accordingly very desirable that punctured units should be located and replaced

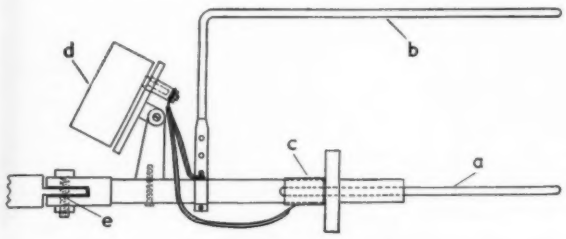


Fig. 1.—Diagram of testing equipment

before the factor of safety of the insulator string is reduced to a dangerously low value.

The only practical and economic method of determining whether any deterioration has taken place is to test the insulators with the line alive. When a string of insulators is in operation and all the units are in good condition, each unit should carry approximately the same fraction of the line voltage. If any faulty units are present in the string the potential drop across these units is abnormally low while the potential drop across the remaining sound units will be greater than normal. Consequently, faulty units can be located on lines in service by measuring the potential drop across each of the insulator units.

Faulty units can be located only if they break down under the electrical stress to which they are normally subjected on the line. For example, a unit puncturing at the low figure of, say, 20 kV might appear to be satisfactory when tested in the line, as the applied voltage would then only be about 10 kV. Various methods have been devised of obtaining the potential distribution along an insulator string and, in the following, the type of testing equipment using an electrostatic voltmeter is described.

Electrostatic Equipment

The testing device consists essentially of a small electrostatic voltmeter mounted on the end of a long insulating stick provided with testing spikes, so that the voltmeter may be connected across the insulator units. In order to

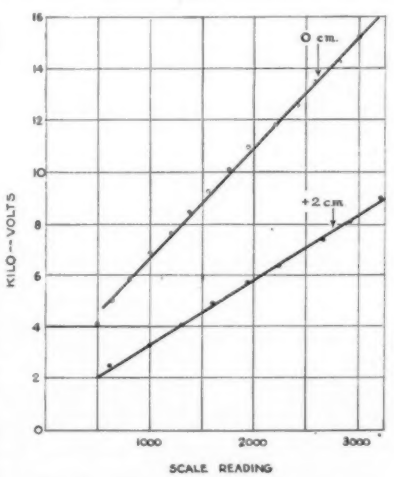
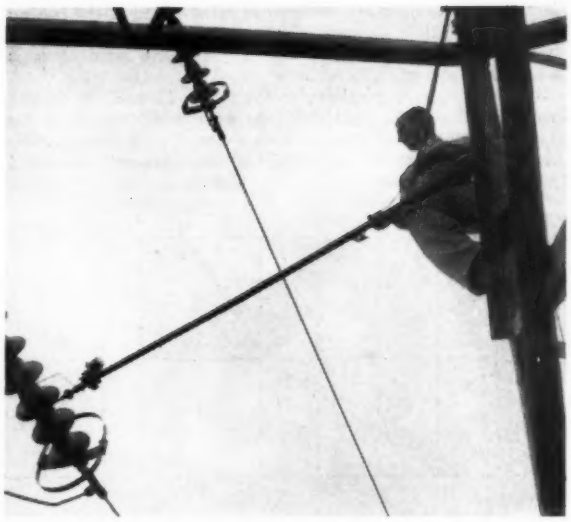


Fig. 2.—Typical calibration curves



Testing tension insulators on a 132-kV line

increase the range of the voltmeter to a suitable value a condenser of high dielectric strength is connected in series with it. This condenser is also necessary for safety, as the difference between the spark-over voltage and the full-scale reading of an electrostatic voltmeter is not large. If the instrument should flash over and thus initiate a flash over of the insulator string, the consequences might be very serious.

The type of construction adopted* is shown in fig. 1. The series condenser is incorporated in the testing stick, the condenser electrodes being one of the testing spikes (a) and the cylindrical collar (c). The capacitance of the condenser can be varied by moving the collar, thus changing the range of the instrument. The other testing spike (b) is set at a distance from the spike (a) corresponding to the distance between centres of the insulator units. The spike (b) can also be rotated through ± 90 deg. from the central position so that the voltmeter (d) may be kept vertical when horizontal strings are being tested. The meter may be inclined at various angles to facilitate reading while the joint (e) enables the head of the stick to be set at an agle so that the testing spikes may be conveniently applied to the insulator units. The meter and associated wiring are electrostatically screened in order to avoid false indications due to inductive effects. Plug-in mounting is provided for the meter so that it may easily be removed for safe transport and calibration.

The meter may be calibrated to read directly in kilovolts for a given setting of the sliding condenser or, alternatively, a calibration chart can be used to convert the scale reading of the instrument to kilovolts, for various settings of the condenser. The typical calibration curves in fig. 2 show that voltages can be measured on the lower range of from 2 to 9 kV, and by altering the condenser setting, up to 16 kV.

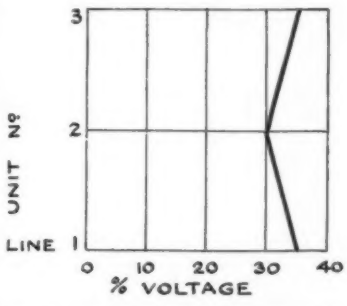


Fig. 3.—Result of measurements made on a sound three-unit string

When making measurements at the highest voltages (say, greater than 50 kV to earth) errors due to induction may occur when testing the line unit. These errors may usually be neglected for practical purposes even when testing 132-kV lines. However, in cases in which greater accuracy is desired, a twin condenser instrument has been designed* in which the meter is connected symmetrically with respect to the testing spikes and to earth. With this form of instrument inductive errors are not appreciable even at 90 kV to earth (150 kV between phases).

Test Results

The equipment is simple to use. The operator holds the testing stick in his hands, applies the spikes to the insulator under test and notes the voltmeter reading. The accompanying illustration shows tension insulators on a 132-kV line being tested. This type of equipment is safe in operation as all the

* Patent applied for.

electrical connections are confined to the live end of the testing stick. In addition, as no earth wire is used a flashover due to the earth wire coming into contact with live conductors is impossible.

In the following typical measurements on 33- and 132-kV line insulators the instrument readings have been expressed for the purpose of illustration in percentage of line voltage.

(a) 33-kV insulators :—33-kV lines are commonly insulated with three cap-and-pin units. The results of measurements made on a sound three-unit string are given in fig. 3, the total voltage being approximately equally shared between the units, although the line and earth units are subjected to a slightly higher stress than the middle unit. The effect of a punctured unit on the voltage distribution is shown in fig. 4 (a), (b) and (c). These results were obtained by inserting a punctured unit in the line, middle and earth positions. The voltage drop across the punctured unit is negligible while the sound units now carry about 50 per cent. of the total line voltage. The exact shape of the potential distribution curves varies to some extent with the type of insulator and fittings employed and with the surface condition of the units. In fig. 5 curve 1 shows the potential distribution for a three-unit string, the line unit being punctured, the middle unit sound but dirty and the earth unit sound and clean; the potential drop across the clean unit is twice that across the dirty one. Curve 2 shows the effect of cleaning the dirty unit; the total voltage is now almost equally shared by the middle and earth units.

Fig. 4.—Effect on voltage distribution of a punctured unit inserted in the line (a), middle (b), and earth (c) positions

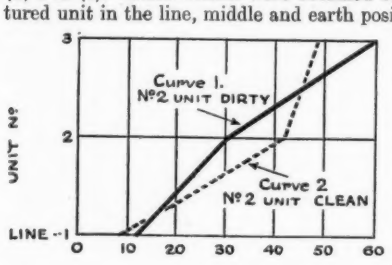
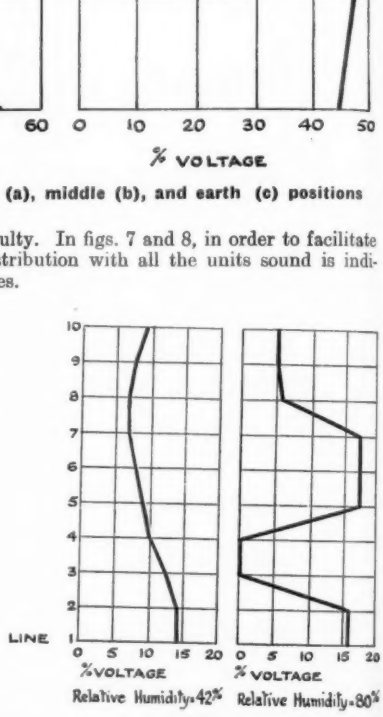


Fig. 5.—Curves showing effect of cleaning

Routine Testing

In practice, however, when carrying out routine testing in order to locate faulty units it is unnecessary to plot the distribution curve. In dry weather for a given type of insulator it is possible to specify that sound units will give a reading lying between certain limits, while units giving a reading below a certain value are faulty. As can be seen from the distribution curves illustrated, the difference between the readings obtained on sound and faulty units is very large so that the operator has merely to glance at the meter reading in order to determine the condition of a unit. No arithmetical operations need to be performed and it is not even necessary to record the instrument reading, although this is usually done as a matter of interest.



Figs. 9 and 10.—Irregular distribution under damp conditions

For various reasons, the testing of insulators on live lines must be carried out only in dry weather. Under damp weather conditions the insulation of the testing stick may be impaired so that the operator is endangered. Moreover, the potential distribution along the insulator strings may be so irregular that the results are useless. Figs. 9 and 10 illustrate this phenomenon, to which long strings are particularly susceptible.

Fig. 9 shows the potential distribution along a ten-unit 132-kV string, the relative humidity being 42 per cent.; it can easily be seen that all the units are satisfactory. In fig. 10 the potential distribution along the same string is shown when the relative humidity is 80 per cent. The distribution is now very irregular and the potential drop across the third and fourth units from the line is now negligible, although these units are sound.

Accordingly, it is essential, with any type of testing equipment, to test in dry weather before coming to any conclusion as to the condition of the insulator units. The irregularity of the potential distribution curve is a natural consequence of the variation, under humid conditions, of the impedance of a

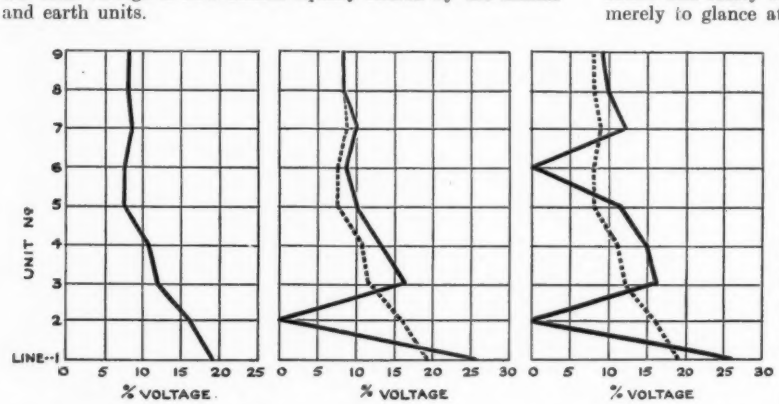


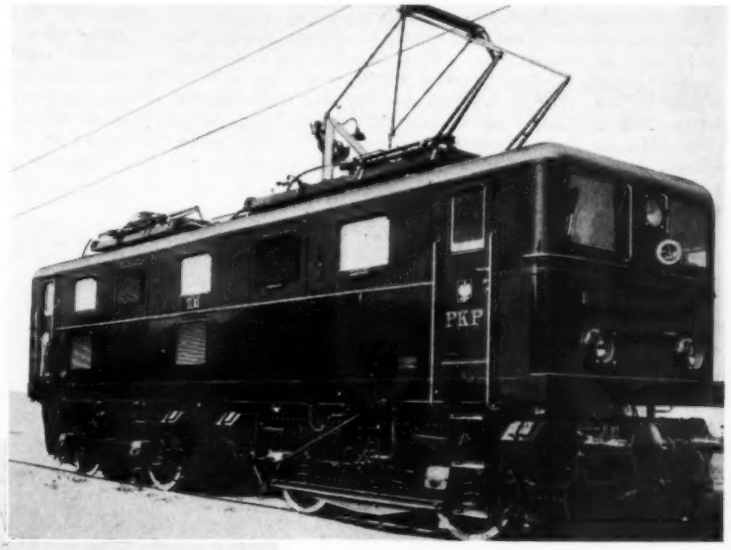
Fig. 6.—Measurements made on a nine-unit, 132-kV string, the insulators being very dirty. Fig. 7.—Effect of replacing the second unit from the line by a punctured one. Fig. 8.—Second and sixth units from the line both faulty. Distribution with all units sound indicated by broken lines

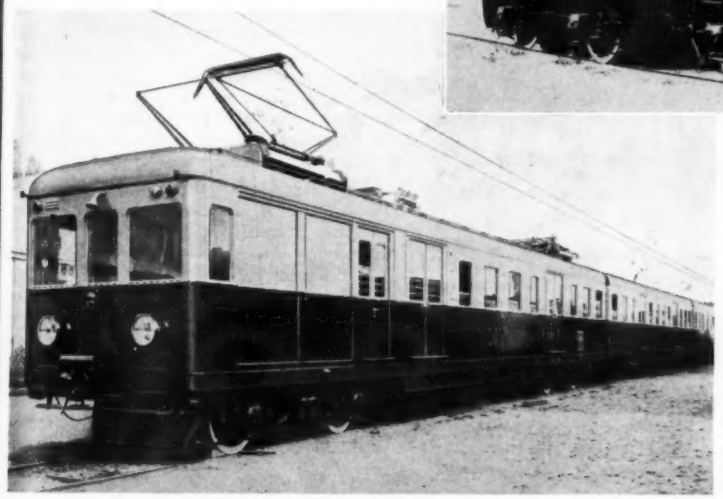
(b) 132-kV lines :—In order to insulate 132-kV lines nine to eleven cap-and-pin units are commonly employed. The measurement of the potential distribution over long insulator strings working at high voltages is more difficult than in the case of short strings. Nevertheless, under dry weather conditions consistent and definite results can be obtained with the electrostatic equipment. The results of measurements made on a nine-unit, 132-kV string are given in fig. 6. The insulators had been in service for some time and were very dirty, so that the potential distribution is slightly irregular. The effect of replacing the second unit from the line by a punctured unit is shown in fig. 7; it will be noticed that the potential drop across the punctured unit is negligible while the sound units have shared the excess potential between them, the units adjacent to the faulty unit being most affected. Fig. 8 shows the potential distribution when the second and sixth units from the line are both faulty. In figs. 7 and 8, in order to facilitate comparison, the distribution with all the units sound is indicated by broken lines.

British Railway Plant in Poland

AS we reported last week, the first section of the extensive electrification of the Warsaw suburban lines of the Polish State Railways was officially opened on December 15th. The contract for this two million pound scheme was signed in London in August, 1933, the work being handled by the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Export Co., Ltd., acting as joint contractors. It covers the electrification of the Warsaw railway junction and suburban lines radiating from the centre of the city of Otwock (28 km.), Zyrardow (43 km.), and Minsk (40 km.). About 200 km. of main track and about 50 km. of sidings are being converted, including the electrification of a new line joining the Central and Warsaw East stations, through a tunnel about a kilometre in length and over a bridge spanning the River Vistula.

The service is operated with overhead line at 3,000 V d.c., power being taken at 35,000 V, 50 cycles, from the existing industrial power supply system. The equipment covered by the contract includes six rectifier sub-stations, six 2,200-h.p. electric locomotives, the complete electrical equipment of seventy-six three-coach trains and four switching locomotives, as well as the overhead line equipment. The overhead line work is being carried out by British Insulated Cables, Ltd., acting as principal sub-contractor. The switchgear and a considerable amount of accessory equipment have been supplied by Polish sub-contractors.





Above: A 2,200-h.p. electric locomotive for the Polish State Railways. Left: A three-coach multiple-unit electric train

Of the sub-stations, one has three 2,500-kW rectifier units; three have two 2,500-kW units each, and two have two 2,000-kW units each. The rectifier units and associated control equipment, main transformers, high speed d.c. circuit-breakers, instruments, relays and supervisory control apparatus have been supplied from England, while all other apparatus including indoor and outdoor switchgear, have been supplied by Polish manufacturers. All sub-stations, with the exception of that at Warsaw West, which is manually controlled, are operated by supervisory control from convenient points. There are also six track cabins equipped with high-speed circuit-breakers for the sectioning of the main line. The main overhead line has bracket arm supports with catenary suspension of dual contact wires; the sidings have similar equipment but with only one contact wire. The scheme of bonding has been adapted for the purpose of track signalling on certain lines.

The locomotives are to be used for high-speed passenger services, and also for hauling freight trains through the tunnel section. They are of 78 tons weight and of the B+B type, having four driving axles, each equipped with a 550-h.p., 1,500-V motor arranged two in series. The control is of the electro-pneumatic unit-switch type. The auxiliaries consist of two 3,000-V combined motor-generator and blower sets, the generator supplying the 110-V d.c. control and auxiliary supply and the blower supplying forced ventilation for the main traction motors. There are also two 110-V motor-compressors for the brake system. Two locomotives are being supplied complete from England. Of the remaining four, the electrical equipment is of British manufacture, while the mechanical parts have been made in Poland.

The multiple-unit passenger stock is made up into three-coach units, each consisting of one motor coach and two trailer coaches. The motor coach is equipped with four coach-ventilated motors (200 h.p., 1,500 V) two being connected in permanent series. A second driving position is provided on the rear trailer coach, which is articulated with the non-driving trailer by a common bogie. The system of control is of the camshaft type, with electro-pneumatically operated line breakers and reverser gear. The control operating supply at 110 V is provided by a 3,000-V motor-generator set, which in conjunction with a nickel-iron battery also provides power for the lighting and compressor circuits.

The coach heating is at 3,000 V with 700-W heaters, four being connected in series across the heater bus line. There are twenty-eight heaters in each motor coach and thirty-two in each trailer. The traction and auxiliary motors and main control equipment have been made in England, while the coaches and certain parts of the control equipment have been made in Poland. The electrical equipment of the switching locomotives is identical with that of the motor coaches, but a driving position is provided at each end.

Live-line Testing (*Continued from previous page*)

porcelain insulator with the applied voltage,* the impedance increasing with the voltage.

In dry weather, although the voltage distribution along the string is uniform, the potential drop across all the units is not exactly the same. When conditions become humid the units having the smallest potential drop tend to have a lower impedance than the remaining units in the string. Consequently, the voltage across the former decreases still further, and as a result the excess voltage is applied to the latter units, thus increasing their impedance and in turn the voltage drop across them. The voltage distribution is, therefore, essentially unstable under humid conditions and the ultimate result is that the voltage drop across some of the units is negligible while the others are working at voltages much in excess of normal.

As a result of field experience, it may be stated that conditions are satisfactory for testing when the relative humidity is less than 70 per cent. and that testing should not be done when the relative humidity is greater than 80 per cent. As a rough and ready criterion it may be noted that when the discharge from the insulators is easily audible the weather conditions are unsuitable.

The main points dealt with can be summarised as follows:—Insulator units which break down in service modify the potential distribution along the insulator chain; the potential drop across the faulty units is negligible while that across the sound units is correspondingly increased. Faulty units can consequently be located by measuring the potential drop across each unit. To obtain reliable results and safety for the operator, testing must be carried out only in dry weather.

* *Journal* I.E.E., October, 1936, p. 406.

The Master of Trinity

By Commander Rollo Appleyard, O.B.E., J.P., M.Inst.C.E., M.I.E.E.

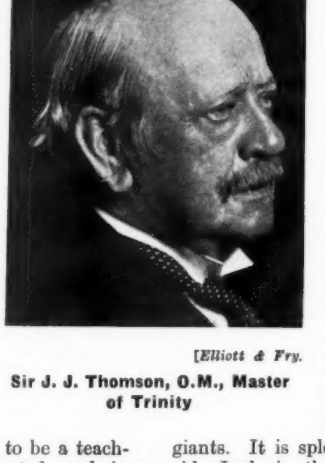
WHEN a Master of Trinity writes a book* it is an event of significance in the domain of literature. This is true whether the author is an ecclesiastic like Christopher Wordsworth, a philosopher like William Whewell, or a leader in natural science like Sir J. J. Thomson. A century ago Dr. Whewell declared that whereas professorial lectures had very small attraction for English undergraduates, the German student pursued the career of his professor with avidity. Whewell found it difficult to keep together a voluntary audience in Cambridge.

To-day, however, when the Master of Trinity speaks, the whole world of science listens. This change is not to be attributed wholly to his distinction as a discoverer, nor is it explained by his skill as a mathematical and experimental physicist. Dr. Whewell was a profound thinker, but so severe a disciplinarian that Sydney Smith said of him that science was his forte and omniscience his foible. In fact it was remarked that

> Through all infinity
> There was nothing so great as the Master of Trinity.

The delightful freedom and friendship, in no way weakening the essentials of discipline, that by common consent have characterised the *régime* of Sir Joseph since his admission to the mastership in 1918, harmonising the philosophical with the social life of the College, have cast their genial rays through the college gate, with what effect can best be judged by examining the story told in the present welcome collection of reminiscences and graphic surveys.

This is not precisely an autobiography; for he has too much to say about others, and about scientific developments in his time, to discourse in detail upon himself. He does tell us, however, that he was born on December 18th, 1856, in a suburb of Manchester, that he went straight from school at fourteen to the Owens College, where amongst other subjects he was taught English and Latin, the first book of Euclid, a great deal of arithmetic, but no algebra, and where he played "shinty," football and single-stick.



[*Elliott & Fry.*

Sir J. J. Thomson, O.M., Master of Trinity

The college had been founded by John Owens to be a teaching establishment without religious tests. It started work in 1851 and after a period approaching failure its advantages became known and it went forward, supported by a brilliant staff that included Balfour Stewart, Osborne Reynolds, Stanley Jevons and H. E. Roscoe. There was also Thomas Barker, a Senior Wrangler and Fellow of Trinity College, Cambridge, who with A. T. Bentley led young Joseph Thomson from arithmetic to quaternions, and thence through all the mysteries of the logic of mathematics.

He went up to Trinity in October, 1876. He tells us that in his undergraduate days Cambridge was by no means dull, there was the gay May-week, good music, cricket and football. He finds to-day that the music is more ambitious, the orchestras larger, and that with more ladies resident the dances are more frequent, with proportionate sacrifice of precious study hours. As a result, undergraduates who happen to be distinguished as good amateur actors, singers or dancers have to depend upon the vacation for their serious work.

In his view, college training should create ability to get quickly into stride for a second theme as soon as a first question is answered. He advocates such training as will create mobility of mind, the retention of knowledge at the fingerends, concentration and, above all, accuracy of thought. This, he remarks, made the old Mathematical Tripos an effective training device, and he cites the great advocate Lord Moulton, a Senior Wrangler, whose examination-marks were double those of the Second Wrangler of his year. Sir Joseph himself took the tripos examination in 1880; he had a short doze during part of it, attributed to an excellent lunch, yet came out of the ordeal as Second Wrangler with Larmor as Senior.

A century ago Whewell wrote that professional education is the study of divinity, medicine and law, that practical knowledge is civil engineering, practical arts, trades and the like, and that practical knowledge can never stand in the place of a really liberal education, though sometimes the energy of youthful zeal and love of knowledge breaks through all difficulties; and he recalled the proud saying: "Let not England forget her privilege of teaching the nations how to live."

Sir Joseph advances from an equally high though not identical standard of education. He reminds us that in Victorian days Cambridge men after taking their degrees went into the Church, read for the Bar, entered the Civil Service, studied medicine, or became schoolmasters, *i.e.*, into what were then the professions. Very few went into business. Now, however, more go into business than into professions, and all can avail themselves of that flourishing branch of the University, the Appointments Board. He observes that the greatest of the modern changes is in the reduced number of those who take holy orders: during the years 1920-1924, inclusive, only 24 out of 909 did so. It is noteworthy that he does not include electrical enginering or civil engineering amongst the professions. They may therefore be judged to stand by themselves, where Whewell placed them. Ours not to profess but to achieve.

Amongst the delightful references made by the Master of Trinity to men who have added charm as well as new knowledge to physics and engineering there is a tribute to the late Sir Richard Threlfall, whom many readers of the ELECTRICAL REVIEW will recall as a friend, and others for his inspiring treatise on laboratory arts. At Cambridge in 1885 the vital question whether "blues" should there be bestowed, as they were at Oxford, for football was raised at the Union. Threlfall who had twice played in the Cambridge team against Oxford arrived late at the over-crowded meeting, and was accordingly perched upon the shoulders of "J. J." and others, from whence he made a speech of such good sense and sparkling humour that he placed the issue beyond doubt. He it was who later ensured the supply of phosphorus for the Great War and who suggested the use of helium to replace hydrogen in airships.

Some readers may think the author goes somewhat out of his way to bring men like Benjamin Franklin and Wollaston into his recollections and reflections; but in the fairy tales of science, of which this is so fascinating an example, there cannot be too many giants. It is splendid to see old Cavendish and the redoubtable Joule in the presence of Housman, Aston, Maxwell, Kelvin, FitzGerald, Einstein and Rutherford. There will be little lost, however, by skipping the chapter on psychical research which Sir Joseph treats with becoming scepticism. He appears to have adopted the decision of Faraday: "I will trust the spirits to find out for themselves how they can move my attention."

The account of visits to America and the close study of American university life and organisation is a valuable addition to a book amazing in the diversity of the subjects examined briefly with sympathy and penetration. The author's remarks on American student-traders, his opinions concerning President Wilson, and his astute comments touching the relative merits of college administrative policies—the despotic "all or none" and the tolerant "give and take"—are products of ripe experience and mature judgment in educational affairs, deserving wide acceptance.

The unfortunate suggestion on page 209 that the detection of submarines by electrical and acoustic methods during the War was delayed owing to the Navy being "divided into two parties, Fisherites and anti-Fisherites" might, with advantage, have been omitted. In the determination to detect and to frustrate enemy submarines the Navy was one and indivisible. Not even Trinity College, Cambridge, can with fairness impugn that unity. Between Lord Fisher and Mr. Winston Churchill there were grave divergences, but in their efforts to encourage the location and destruction of enemy submarines by all possible applications of science, art, and skill they were in complete accord. For the design of hydrophone microphones and other electrical and acoustic equipment help came voluntarily from expert telephone engineers of experience and from telephone equipment manufacturers. This was but part of the task of providing for sea-going conditions.

Throughout this remarkable record of Sir J. J. Thomson's achievements, contacts and impressions there is evidence of his devotion to natural philosophy, of his appreciation of the task of the teacher and leader, and of his never-faltering desire to make provision for social needs as well as for instruction. Towards the end he tells briefly of the more important of his victories over space, time and matter.

For concise statement, perfection of mathematical demon-

* "*Recollections and Reflections.*" By Sir J. J. Thomson, O.M., D.Sc., F.R.S., Master of Trinity College, Cambridge. (G. Bell & Sons, Ltd.)

Meetings and Discussions

Mr. F. W. Purse's paper on the evergreen subject of tariffs called forth the usual criticisms at last week's meeting of the Supervisors, many speakers putting forward their panaceas. The I.E.E. discussed the papers by Prof. W. M. Thornton and Messrs. Trencham and Wilkinson, which we reviewed last week, while at a meeting of the Institution of Mechanical Engineers Mr. P. W. Seemer spoke of the hydro-electric work carried out by British and foreign concerns.

What is the Best Domestic Tariff ?

THE paper read by Mr. F. W. Purse on "Development of Domestic Load in Relation to Tariffs" before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS (reported in last week's issue, page 855) proved to be one of the most controversial subjects which the Association had ever discussed. In reply to his plea for a universal method of charging on the size-of-house basis, Mr. Purse met with an onslaught of opposition from advocates of almost every kind of tariff; in fact, in his summing up he said that such diversity of opinion led him to believe that standardisation would be an impossible ideal unless a very special effort were made.

The block tariff, which is popular in America, found a defender in the person of the chairman, Mr. H. Hobson, who, while recognising that costs were in two parts, did not subscribe to the theory that retail prices and costs need be correlated in form with generation costs. If there were a fixed charge the variations in the cost of distribution in urban and rural areas should be allowed for in the fixed charge instead of the "unit" charge.

A historical survey of the two-part tariff was made by Mr. A. H. Dykes with its development from the contract demand ("telephone") system and maximum demand systems. He supported the rateable-value basis against the size-of-house method on the grounds that more apparatus was usually installed in a higher-rated house as well as the fact that the occupier would be in a better financial position to pay. (This argument did not meet with favour.) The burden should be put on the shoulders best able to bear it. In addition the r.v. tariff was fixed by an independent authority and averted disputes. He deprecated the tendency to lower the flat rate below 6d. otherwise benefit would be given to the consumer with a poor load factor and development of the two-part tariff would be stultified.

"Why should the rate for electricity be based on income?" asked Mr. Cramb (like Mr. Purse, a member of the Electricity Commissioners' Tariff Committee). "The prices of other household commodities are not varied on these grounds." He backed Mr. Purse in his plea for uniformity, maintaining that a multitude of tariffs was one of the greatest bugbears in the industry; the public could not understand the necessity for them (upon which Mr. Purse commented, in summing up, that the less progressive undertakings favoured discrepancies—it prevented comparisons). Finally, Mr. Cramb asserted that the r.v. tariff was full of anomalies from beginning to end.

Another speaker stressed the selling side and said that rates of 0.7d. per kWh were a bad influence psychologically, while still another suggestion was that a certain amount of electricity should be provided free to show that the fixed charge was not paid for nothing—to which Mr. Purse replied that it was always his endeavour to keep the fixed charge as low as possible.

One member made a provocative speech demanding a flat rate only. There might, he said, be some justification for a special lighting tariff. If a two-part tariff were absolutely necessary a kW maximum demand charge would be best. Mr. Brammer said that the fixed charge was unpopular with the consumer because he saw nothing for the money, but the size-of-house basis was fairer than the r.v. system, where the consumer paid according to the district he lived in. A system of averaging was suggested by Mr. J. M. Kennedy: for instance, £4 p.a. and ½d. per kWh, or a block tariff as suggested by Mr. Hobson. In reply to this Mr. Purse stressed that it would penalise the small consumer, who would change over to gas. With a small house he could not hope to get into the second block, even with a cooker. But we must, he said, get standardisation somehow. This meeting had shown that there was as much disagreement now as there was forty years ago.

The Master of Trinity (*Concluded from previous page*)

stration, and enjoyable reading it would be difficult to match and impossible to surpass this record of genius and the mode of its presentation. In his own words and symbols he tells of his great adventure in the forest of scientific notions, and amongst the highest peaks in that land of next to nothing from whence he has brought us nearly everything. Students may observe that he thinks in terms of energy, preferably kinetic, not dwelling too much upon the transformation of one kind into another, but rather upon the transference of the same energy from one system to another. Moreover, as a disciple of Maxwell, he is a firm believer in the efficacy of Lagrangian equations as a help in trouble.

The search for the perfect tariff
Circuit-breaking considerations
Hydro-electric plant

Small and Large Circuit Breaking

THE two papers, to which reference was made last week, in which Prof. W. M. Thornton dealt with the micro-gap switch and Messrs. H. Trencham and K. J. R. Wilkinson emphasised the effects of restriking voltage on circuit-breaker operation were discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 17th.

Mr. L. Satchwell showed a large number of oscillograph records obtained when breaking currents between various types of contact, his object being to demonstrate the great advantage of the micro-switch over high- and low-speed switches. He emphasised the great value of the micro-switch for thermostatic control purposes. Mr. K. J. R. Wilkinson demonstrated the restriking voltage indicator mentioned in his joint paper and Mr. C. H. Flurscheim (Manchester) said this indicator had already proved itself of value to designing engineers and

"As the twig is bent. . . ." Girls at the Shirley Schools, Wickham, imbibing the electrical idea at a cooking class

it would also enable the calculation of leakage and cut-off currents, without the laborious processes now necessary, by simple deduction. It would also permit quantitative analyses to be made on systems of what the actual restriking rates were, which had not been practicable before because system engineers objected to short circuits being applied to their systems for actual measurements to be made.

Mr. L. Gosland (British Electrical & Allied Industries Research Association) said his Association had carried out a number of tests with one of these instruments which had confirmed all that had been claimed for it. But it suffered from the limitation that at present it could not be applied to large power systems, because it was very seldom that such systems could be made dead in order to allow such records to be taken. If a record was taken on an isolated portion of a system a correction was required. Mr. V. A. Brown said he had already expressed appreciation of the indicator in the Manchester discussion for in the station with which he was associated it had done yeoman service. There were over 1,800 circuit combinations to calibrate with respect to restriking voltage and without this instrument it would be the work of a lifetime.

Mr. C. J. O. Garrard remarked that the indicator provided a powerful new means for research. In spite of the large amount of money that had been spent on building and running testing

stations in this country in recent years, the results so far had been somewhat disappointing. He did not mean that the results as regarded the circuit-breakers which had been produced had been disappointing, but he did not see at present much sign of the emergence of co-ordinated practical and theoretical knowledge. It would be to the advantage of everybody if a greater degree of collaboration could be obtained. The problems to be solved were so difficult, and the work to be done so expensive and elaborate, that it was hopeless for any one manufacturer to attempt to do it. The correct interpretation of the results given by the instrument still required a great deal of research.

Mr. J. Keyes Brown said that if they went to supply undertakings with this instrument and asked for their systems to be isolated so that measurements could be made, he feared they would not be very well received. Therefore, he regarded this instrument as a useful tool for analysing networks. Mr. J. D. Knowles agreed that a detailed and logical review of the whole subject of circuit breaking was due and that there should be co-ordination of research with regard to it.

Mr. W. B. Whitman said that a considerable amount of co-operative work had been carried out during the past year. Cathode-ray records had been made of quite large systems in this country and the results would be published very shortly. Mr. F. E. Ockenden, referring to Prof. Thornton's paper, asked whether there was any possibility of the contacts pitting or oxidising and permanently closing in that way. Dr. E. H. Rayner asked whether the power factor was of any importance in connection with the micro-gap switch. In some countries, such as India, there was an immense demand for a.c. fans which normally had a power factor of 0.6. Was that low enough to put the micro-gap switch out of action on account of the induction in the circuit? Was there any possible application of a switch of this kind to prepayment meters?

Prof. W. M. Thornton, in reply, said he believed the micro-gap switch would work at all loads and it could become an automatic overload release. It was also the fact, he believed, that the best results were obtained when the switch opened suddenly, and then there was no pitting. Mr. H. Trencham promised a detailed reply in writing. He said that it was necessary to wait until there was quite a large amount of accumulated evidence before any attempt could be made to generalise.

Water-power Machinery

THE more important aspects of recent progress in hydro-electric engineering, with special reference to British practice, are outlined in a paper by Mr. P. W. Seemer (consulting engineer and chief designer, Hydro-electric Department, English Electric Co., Ltd.) which was read before the INSTITUTION OF MECHANICAL ENGINEERS in London on December 18th.

In order to secure a share of the world's output of hydro-electric machinery it has been necessary for British engineers to create new features of design affording real advantages to the prospective user, and it is the purpose of the present paper to describe the more important of these features, which are chiefly mechanical in nature. For instance, they include an automatic aerofoil flow recorder, which provides a means of operating automatically relief valves and other discharge apparatus, an automatic governor-actuator with mechanical drive, a cylindrical balanced valve and discharge regulator, and a hydraulic brake which utilises the runner wheels as brake drums. Such a brake is desirable not only in emergency, but also to protect bearings from the ill effects of slow running during deceleration. Much attention has also been paid to the design of a satisfactory bucket fastening for impulse wheels, and welding is now extensively adopted for the fabrication of spiral casings, &c., and in conjunction with the use of alloys as a protection against cavitation. The usual design of vertical-shaft power house involves two or more floors with many attendant disadvantages. To overcome these a new type of rigid connection between turbine and generator has been evolved which permits of the employment of a single power house floor.

In almost every hydro-electric scheme nature imposes peculiar conditions, which often make it necessary to resort to extensive experimental work in order to achieve the best results. The company with which the author is associated has thus been led to establish its own industrial test plant which is, so far as the author knows, the first and only one in the British Isles, apart from the experimental laboratories in technical schools, the purpose of which is chiefly educational. This plant enables extensive tests to be made on model turbines and their accessories. It is established within the factory area so that research can be carried out in constant contact with the design and manufacturing staffs. Consistent and reliable tests under steady conditions are obtained by recirculating water by means of a 130-h.p. variable speed motor pump in conjunction with special tanks which allow of exact adjustments and measurements being made. With this arrangement it was possible to install the experimental plant within the works and render it independent of river fluctuations.

Both vertical and horizontal-shaft turbines can be investigated and the tests made with this plant, especially efficiency tests, have always shown excellent agreement with the results obtained from the full-size machines in the field. It is, however, necessary to apply correcting factors to take into account scale effect. The money invested in the test plant has been amply justified by the invaluable aid it has afforded in devising improved forms and elements of turbines and their accessories.

One of the most pronounced features of British practice is the comprehensive way in which hydro-electric schemes are being developed. Constant contact between the hydraulic and electrical engineers allows the machinery to be treated as a whole "hydro-electric set."

The paper concludes with particulars of recent developments abroad. For example, the Kembs plant on the Rhine in Alsace consists of five vertical machines producing 30,000-36,600 h.p. at 48-54 ft. head and 93.7 r.p.m., each set passing 187 tons of water per second. A unique feature of this plant is the discharge of the waters of the Rhine through the power house building by way of apertures or canals arranged between the turbines and generators; it is due to the fact that the power house closes the canal over its whole width and it was necessary to provide for the rapid and direct discharge of the whole quantity in case of total or partial sudden drop in load on the plant. This design is simple and very ingenious and is protected under patent laws. It obviates a considerable widening of the canal for a discharge weir, which would have been very much more complicated and entirely prohibitive as regards cost.

The Ryburg-Schwoerstadt plant on the Rhine near Rheinfelden, in Switzerland, is one of the largest and most modern on the Continent. There are four 42,500 h.p. vertical Kaplan turbines, passing 300 tons of water per sec. under 41 ft. head at 75 r.p.m.

The Dixence plant at Sion, in Switzerland, is one of the largest high-pressure installations in the world. It operates under a head of 5,750 ft., the highest pressure ever utilised in one stage. The discharge of 10.25 tons per sec. under average head corresponds to an effective output of 133,250 kW, or nearly 60 kW per gal. per sec. There are five sets of 30,000 kW at 500 r.p.m. and an auxiliary 7,000-kW set. A remarkable feature of these 50,000-h.p. sets is that the housings of the turbines are arranged so close to the runner wheels as to cause the latter to run practically in a vacuum. There is thus a gain in output and efficiency because of reduced windage loss of the runners, whose normal circumferential speed is nearly 300 ft. per sec.

There are in continuous operation in Germany, Switzerland, France, Italy, Spain, Sweden and the United States hydraulic accumulating plants yielding outputs often in excess of 100,000 kW per individual station and containing hydraulic turbines, chiefly of the reaction type, of from 40,000 to 50,000 h.p. operating in conjunction with multiple-stage centrifugal pumps of up to 34,000 h.p. and more individual capacity. Synchronous motors are arranged between the turbines and pumps which alternately generate power when driven by the turbines, or operate as motors when driving the pumps. Nine of the more important stations of this type in Germany alone have at the present time a capacity in excess of 1,000,000 h.p.

Hydraulic accumulation is, therefore, well established and is recognised everywhere as an excellent and economic method of covering peak loads.

Typical examples are mentioned in the paper, which states that accumulation plants of the horizontal-shaft type, while requiring larger and wider buildings, present a number of important features which, in the author's opinion, render them distinctly superior to vertical-shaft installations.

Students' Views

FOLLOWING the successful innovation of a Problems Night last year the North-Western Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS held a similar meeting in Manchester on December 8th. The opening discussion on "Coil *v.* Magneto Ignition" was vigorous. For the magneto it was stated that it was a self-contained unit, independent of any external source of electrical energy, which had proved its reliability in divers situations. Against this, while a coil-ignition system depended solely upon the vehicle battery for operation, such batteries had to be extremely reliable as many other major auxiliaries depended upon it. Moreover, coil-ignition was cheaper. A show of hands revealed an almost unanimous preference for the coil-ignition system.

"Industrial Rationalisation" was held by several members

to be the major cause of many of this world's ills, in that the smaller traders and manufacturers tended not to be absorbed but obliterated. Among the advantages of rationalisation was that the greater capital could earn more prestige and enable better brains to be bought; that it would enable undertakings to be conducted on a larger and more efficient scale, thus further increasing capital; and that the amassing and interchange of knowledge would still further enhance a rationalised company's products and business standing. The meeting as a whole appeared to be generally in favour of rationalisation.

Dealing with the merits of the four principal types of electric hot-plates now on the market (solid plate, radiant, wire-wound, and low-voltage transformer operated) it was held that for long periods of continuous use, the solid type was the most suitable on account of its general robustness, but where quick boiling was required a radiant hot-plate was preferable. Solid hot-plates called for the use of specially heavy flat-bottomed cooking utensils, whereas ordinary pots and pans could be used with radiant plates. A type of combined electric hot-plate and oven was described in which by placing the reflector above the radiant heating element the oven was made effective, and by placing it below the heater a good hot-plate was formed. It was thought by some that facilities for finer temperature and heat control would make hot-plates more popular, but it was recounted that in the early days of electric cooking a hot-plate had been developed having nine different degrees of heat control; as this was not at all popular it was abandoned. The wire-wound radiant type appeared to be giving way to the transformer operated pattern which admittedly had the advantages of robustness and faster operation, and now held the field for purely domestic purposes.

Considerable ingenuity had been displayed by domestic consumers in trying to defraud undertakings by tampering with meters according to the practical experiences of several members, who described the various methods adopted.

The principles and merits of the Baird and E.M.I. systems of television transmission were outlined, the fundamental differences in the methods of scanning being emphasised. For the reception of either system the cathode-ray tube was generally used for the smaller size pictures, but mechanical devices for larger pictures, *e.g.*, for cinemas.

The discussion on "Is High-Speed Electric Traction Justified?" became a debate upon whether or not it was even possible. In this modern world anything that would save time would be justifiable providing it did so at reasonable cost, and it was taken for granted that high-speed electric traction would fulfil these conditions. It was stated that on British railways electric traction was only under consideration for lines which were already heavily loaded (for example, the new Manchester-Sheffield electrification), where really high-speed traction of any kind would be impossible due to the long signalling distances and headways required. Reference was made to the underground railways of the L.P.T.B., but it was stated that these were not really high-speed traction systems, the maximum speeds attained being only about forty miles per hour.

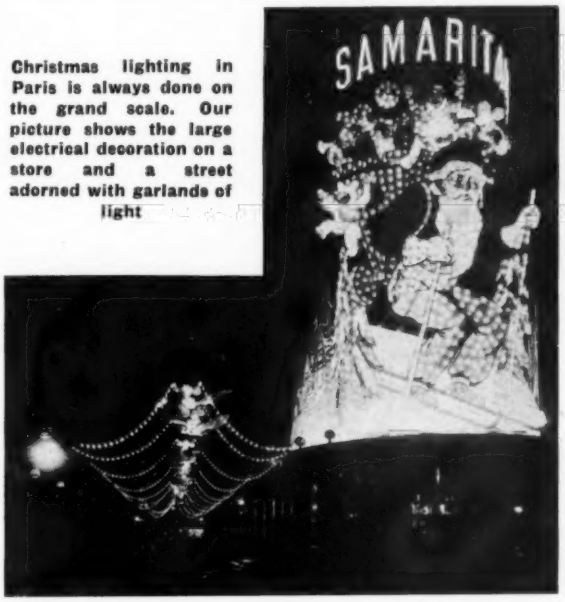
X-ray Crystal Analysis

THE manner in which crystal analysis is being carried out with the aid of X-rays formed the subject of the Trueman Wood memorial lecture, delivered by Sir William Bragg, director of the Royal Institution, before the ROYAL SOCIETY OF ARTS in London on December 16th. Sir William stated that during the last thirteen years about ten thousand papers had been published in various journals, dealing with this subject in one way or another. Certain lines of investigation had produced notable results and in the present paper Sir William sketched some of the more interesting.

He explained that in every crystal there was a unit of pattern, and the crystal was built of repetitions of this unit in three dimensions of space. Every unit was exactly like every other in composition and internal construction, and similarly oriented with respect to the crystal. The unit contained a certain number, usually quite small, of molecules and atoms. The dimensions of the unit were so much less, thousands of times less, than the wave-length of visible light, that it could not be perceived by optical means. The wave-lengths of X-rays, being about ten thousand times shorter than those of light, could be used as a means of detection when visible light failed.

There was a certain way of interpreting the X-ray observation, which resulted in the formation of a shadow picture of the contents of the unit cell of the crystal, and enabled one to "see" molecules. The process of making these shadow pictures accurately was laborious, but the labour was well spent, because in this way one gained a new insight into the construction of matter. It furnished an indication of the relation between construction and properties. From shadow pictures the distances separating neighbouring atoms could be calculated with an accuracy within one per cent., and the application of the X-ray methods to the metallurgical study of alloys had been particularly useful.

Sir William said that it might be supposed that if we knew enough about the structure of the individual atom, we should be able to foretell the properties of any alloy if we were given



Christmas lighting in Paris is always done on the grand scale. Our picture shows the large electrical decoration on a store and a street adorned with garlands of light

the arrangement of its component atoms, an arrangement which the X-rays would find for us. Or even further, we might predict the arrangement if we knew the relative proportions of the constituent atoms, as well as the temperature and other pertinent conditions. We were very far from the possession of such powers, but could determine the arrangement of the atoms in any given case, which knowledge, though limited, might be very useful. It gave an exact knowledge of the boundaries of an alloy phase, and a new method of drawing the metallurgist's phase diagrams.

Perfect crystals of any size were comparatively infrequent. During the process of the arrangement of atoms and molecules in perfect array, which constituted the building of a crystal, disturbances from without were apt to interfere. The supply of the necessary material might fail or change its character, temperature might vary, mechanical disturbances might take place. Consequently the vast proportion of the materials of the world did not assume the form of visible crystals, although some attempt at arrangement was always present. Very often the conditions of formation caused the material to acquire a texture; it was a mass of minute crystals.

In metallurgy and solid substances generally, the matter of texture was of great importance. Metals that were rolled or drawn or hammered showed special orientations of the minute crystals of which they were usually composed. As soon as it was found that the X-rays could reveal the consequences of mechanical treatment upon the structure of a metal, investigation by the new method came into prominence. The microscope had for many years been used to examine the outlines and dispositions of the grains of a metal, the details being brought out by etching a suitable section. The X-rays went deeper into the matter, showing the orientation and character of the grains even when they were sub-microscopic.

Electricity in Mines.—At a meeting of the South Wales Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS on December 12th, Mr. S. B. Haslam (branch president) in the chair, the report of the Electrical Inspector of Mines for 1935 was discussed. Mr. J. B. Horsley was present, and stated that the number of pieces of apparatus accepted for flame-proof testing increased to 260 in 1935 from 169 in 1934. These ranged from push-buttons and signal keys to coal-cutting machines. Allowing for duplicate certificates and variations, 248 official certificates had been issued, including those for seventy-three induction and eleven d.c. motors. The use of d.c. in mines, he said, appeared to be dying out.

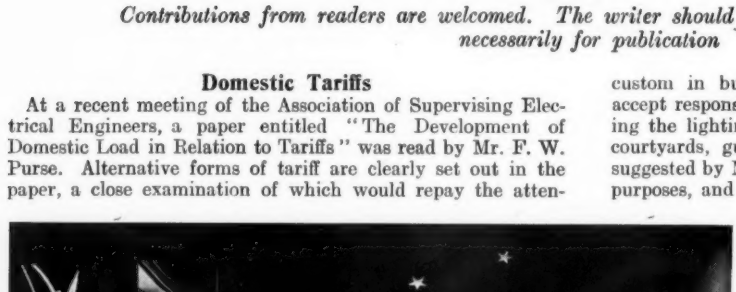
About 46 per cent. of the 16,000 h.p. connected in 1935 was represented by coal-cutting machinery. Fires on cables were often caused by the repeated closing of switches on faults. Inadequate gear well maintained was generally better than modern equipment that was ill cared for. Although the number of mines working last year was reduced by forty-eight, those using electricity were only reduced by four; 64 per cent. of the working pits were electrified as against 62 per cent. in 1934.

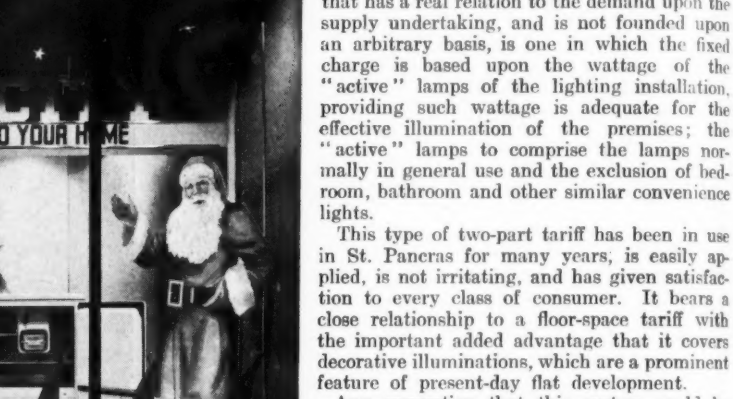
Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Domestic Tariffs

At a recent meeting of the Association of Supervising Electrical Engineers, a paper entitled "The Development of Domestic Load in Relation to Tariffs" was read by Mr. F. W. Purse. Alternative forms of tariff are clearly set out in the paper, a close examination of which would repay the attention of supply engineers. In this paper the author very properly draws attention to the chaos and confusion existing at the present time due to the multiplicity of tariffs in operation, and makes a forcible plea for the adoption of a standard two-part tariff that could be universally applied throughout the country for the supply of electricity to domestic premises.





Two electrical Christmas displays. Above: The E.D.A. window at the Building Centre. Right: One of the G.E.C. windows at Magnet House, Kingsway

There can be no question that a real and growing demand for such a tariff exists, and that a simple and universally framed tariff that could be applied equitably in all parts of the country would be welcomed by consumers, and be of immense publicity value to the electrical industry. It is, therefore, the more surprising that the only difficulty appears to be the apparent impossibility of reaching agreement as to the principle upon which the primary or fixed charge should be based.

Mr. Purse is of the opinion that the most suitable system for universal adoption is the size-of-house tariff, under which the fixed charge is based upon the outside measurement of each floor or storey; this was the system recommended by the Committee set up by the Electricity Commissioners in 1929 to consider the various kinds of tariffs offered by authorised undertakers.

It is my opinion, however, that the view of the engineer and manager of a supply undertaking is unconsciously influenced by the type of property most general in the area under his control, and in this connection I would suggest the possibility that Mr. Purse views the position from a somewhat rural aspect. It must be remembered that the major portion of electricity consumed for domestic purposes is, and will be, in the towns and cities, and not in the rural areas, and that owing to the lack of space the type of house now being erected and profusely advertised and illustrated in the daily and weekly newspapers does not exist in the central areas.

Whether we like it or not we are faced with the fact that the development of the times in all large centres of population, and particularly in London and its suburbs, is towards the erection of groups of flats with varying accommodation and housing from fifty to 1,000 families. It is the invariable custom in buildings of this description for the owners to accept responsibility for the service facilities provided, including the lighting required in connection with halls, corridors, courtyards, guest rooms, &c., and I submit that the tariff suggested by Mr. Purse is not suitable for application for these purposes, and therefore fails in universal application.

I therefore suggest that the tariff that could be universally and equitably applied throughout the country without anomalies, that has a real relation to the demand upon the supply undertaking, and is not founded upon an arbitrary basis, is one in which the fixed charge is based upon the wattage of the "active" lamps of the lighting installation, providing such wattage is adequate for the effective illumination of the premises; the "active" lamps to comprise the lamps normally in general use and the exclusion of bedroom, bathroom and other similar convenience lights.

This type of two-part tariff has been in use in St. Pancras for many years, is easily applied, is not irritating, and has given satisfaction to every class of consumer. It bears a close relationship to a floor-space tariff with the important added advantage that it covers decorative illuminations, which are a prominent feature of present-day flat development.

Any suggestion that this system could be abused could not be sustained for the reason that the wattage of the lamps taken into assessment must be not less than that deemed adequate for the effective illumination of the premises.

ROBERT LEE,
Chief Electrical Engineer and Manager.

St. Pancras, N.W.1, *December 18th.*

Electricity and Local Rates

There is one aspect of the contribution from the electricity revenue towards relief of the rates where the undertaking belongs to a municipality on which I would like to comment.

It is agreed, I think, by everybody that the Electricity Department should not be turned into a "taxing" one; at the same time, to limit the contribution to a percentage of the "outstanding" debt seems to be a vicious principle. The danger in this case of management of debt in the interest of contributing large sums to the general revenue of the local authority is referred to in the last paragraph of the article on "Electricity and Local Rates" by P. V. Harrap, in your issue of October 30th, and this principle should be abandoned. Otherwise there will always be a tendency not to reduce the outstanding debt to zero.

In Simla the Municipality has allowed the Electricity

Department to pay off all its debts, taking a minimum from it in the past years for general purposes from its revenues. This has enabled the Department to charge a low rate for energy, especially taking into consideration the extremely seasonal nature of the load in India's summer capital, and at the same time to put by a sum as reserve fund for emergencies, and to finance all extensions necessary from the accumulated revenue balance, after paying a fixed yearly sum towards the relief of the rates which is now fixed at Rs. 90,000 per annum.

This position would not be possible if the contribution could not exceed 1¼ per cent. of the outstanding debt, as then to raise Rs. 90,000 there would have to be an outstanding debt of Rs. 60,00,000 and interest would have to be paid on this sum.

The amount that a municipal committee takes from the Electricity Department should be, in my opinion, a function of the present value of the system and its revenue. The present value should not include any sum for goodwill or for its being a going concern, but should be the cost of the various plant, &c., less depreciation. Then there will be an incentive to development, as the larger the system and the revenue, the larger the amount which the local authority will be enabled to take, and the interests of both the consumer and the ratepayers will be served.

It might be argued that the consumers will generally be the ratepayers. This does not necessarily follow. Very often the rates are paid by the landlord, who may find it hard to raise the rents when the rates go up and will most certainly not voluntarily reduce rent when the rates go down, while the electricity charges are always born by the tenant. Again, even where the rates and the charges for electricity are borne by a tenant, the incidence will be such that in many cases an increase in the electricity charges will be more than offset by the reduction in rates, while the reverse will be case in others.

So in order to be fair to all consumers of electricity, both power and domestic, watch must be kept that, while the department is not turned into a taxing one, incentive is given to the committees to run the supply in the most progressive and efficient manner by correlating with this the amount that they can take for general municipal purposes from the Electricity Department. R. L. NARAYANAN,

Electrical Engineer, Municipal Electricity Dept.

Simla, *November 30th.*

Pensions for Dependants

A short time ago a former chief engineer and manager of an electricity undertaking died. Despite the fact that he contributed to the superannuation scheme his widow was not even able to claim the widow's pension that is granted to the widow of a workman—no provision having been made at all for her. In contrast to this the widow of a former chief constable was granted a pension of £125 per annum.

It is very regrettable that the superannuation schemes in force at present in the electricity supply industry do not make provision for the dependants of former members. It is in the interest of present members of the corporation superannuation schemes to have new regulations framed so as to bring their schemes into line with the Police Pensions Act to make provision for their dependants. CORPORATION EMPLOYÉ.

December 4th.

Coal for Power Stations

One way of reducing the price of coal to generating stations which must have entered many engineers' minds is that of cutting out the middleman, who often gets more profit per ton than does the man who works at the coal face.

No doubt many agents and contractors have been very helpful to engineers, in that they have found the coal wanted, kept collieries up to scratch, and given power station men a very fair deal. Combustion engineers, in many cases, have not the time to do one half of what many agents and contractors have been able and willing to do for them—often without any recompense—and such engineers would have been willing to have paid them for what they were able to do.

But with a central authority, which could purchase all fuel for all generating stations, engineers would not require the middleman, and his profits could be shared by the buyers and sellers, the latter passing some or all of their share to the miners themselves, and in this way obviating the necessity of an increase in actual rates of pay, rather keeping men working full time. The purchasing body must not be a costly one, else all will be worse off; and it must do more than did the colliery agents as it will be expected to run efficient laboratories, and to advise on the combustion of the fuel allocated.

Generating stations must have a low-priced fuel; the colliery owners must have their profit; the miners must have a good living wage; and the country must have cheap supplies of electricity, otherwise the purchasing commission cannot justify its existence. Such a state of affairs can be brought about, and the Electricity Commissioners could bring it about if they were given the powers, and their hands were not tied.

The colliery agents and contractors, who would be cut out as regards steam-raising fuel, would not stand to lose; their services would be invaluable in an advisory capacity, as they know the fuels and markets in their respective areas as no other man can, and station men would welcome them on any advisory boards set up. D. SHIPTON WOOD.

Birmingham, *December 17th.*

The Business Side of Electricity Supply

Mr. Bolton in his article published in your current issue brings up once again the vexed question of tariffs, a matter which should at all times be put to the forefront of everything connected with the supply of electricity. More often than not, however, technical matters are given priority of discussion between chiefs and their staffs. Every large business undertaking in the world has been built up not merely because the articles or service are the best of their classes but because they are the *cheapest* of their kind; this should apply to the supply of electricity.

Another drawback, to my mind, is that instead of having a purely business man at the top in a supply company the appointment is generally combined with that of engineer; under this system it would appear that a person who is a good engineer must necessarily be a good manager, showing obviously faulty reasoning.

Mr. Bolton wonders why such widely varying commodities and services as gas and water supply, postage, and telephones are all capable of unification over wide areas. Gas and water supplies certainly are not supplied at anything like a uniform rate throughout the country, while the postal and telephone services are nationalised.

It is of little use shirking the matter and wondering what would happen to all connected with the supply of electricity if the industry was nationalised. The thing to do is to get down to brass tacks and anticipate trouble before it comes, as it surely will, to some of those persons connected with the supply of electricity who will inevitably be superfluous.

December 19th. TRULY RURAL.

Electrical Aids for the Deaf

We see that a correspondent, Mr. W. E. Burnand, in your issue of December 11th, raises the question of automatic volume control on deaf aids. We feel sure that he will be interested to know that we have been making such apparatus in the form of miniature three-valve amplifiers for some considerable time.

We have proved by oscillograph tests that no wave form distortion is introduced by the control while the amplification obtained for weak signals may be raised as high as 50 db.

MULTITONE ELECTRIC CO., LTD.

London, W.1, *December 19th.*

National Association of Radio Retailers

AT a general meeting of the above Association on December 14th the President, Mr. H. M. Drake, reported that two meetings of the Provisional Council had been held and business had mainly been confined to the election of members and to matters connected with the formation and policy of the Association. With a view to getting rapidly to work on problems affecting the retailer, an early meeting with the Radio Battery Makers' Association was being sought and steps taken to make direct contact with other sections of the industry through their respective organisations. The Council had also discussed the matter of qualification for membership and had decided that all matters pertaining to public address engineers and equipment came definitely within the province of the Association. Arrangements had been made to cover all districts with details of activities by circulation, and the Council had made suitable arrangements for representation and the running expenses of any branch which might be inaugurated. With regard to the more prominent and urgent difficulties facing the radio retail trade steps were being taken to lay the Association's views before the competent authorities.

Foremost in the Association's policy would be immediate contact with the radio manufacturers and their existing organisations. Retailers should receive adequate discounts, and the Association proposed to make its views known fully on this question, and to take such steps in the matter as might be necessary. Regarding hire-purchase the N.A.R.R. advocated standardisation, the simplication of terms and conditions of guarantees, uniformity in drafting of agreement forms, and prompt cash settlement to the retailer. Servicing was considered to be an essential part of a dealer's business. Members must be in a position to give adequate service, and the Association would press in return for freedom of service facilities and the ability of dealers to obtain spare parts at trade terms, whether holding agency agreements or not.

D

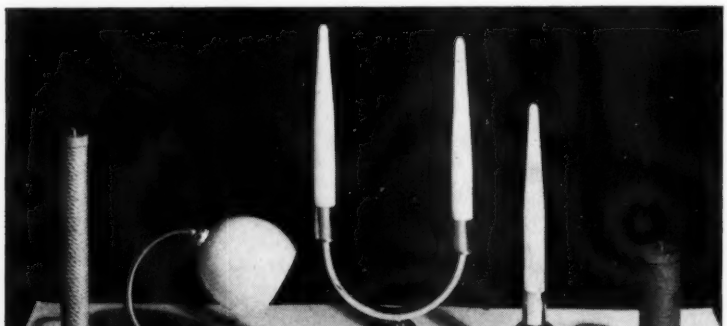
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

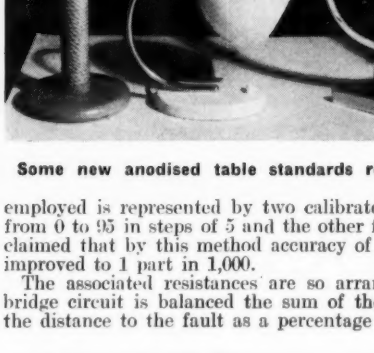
Direct-reading Fault Localisers

The new direct-reading fault localisers of the CAMBRIDGE INSTRUMENT COMPANY, LTD., 45, Grosvenor Place, S.W.1, have two features which are designed to simplify reading and to give increased accuracy when locating earth faults on power cables by means of the Murray loop test. The slide wire usually employed is represented by two calibrated dials, one marked from 0 to 95 in steps of 5 and the other from 0 to 5, and it is claimed that by this method accuracy of calibration has been improved to 1 part in 1,000.

The associated resistances are so arranged that when the bridge circuit is balanced the sum of the dial readings gives the distance to the fault as a percentage of the length of the section under test and not as a fraction of the total length of loop, a feature suggested by Mr. G. F. Shotter, A.M.I.E.E., of the North Met. Co.



Some new anodised table standards recently introduced by Bennett & Co.



H.v. direct-reading fault localiser

The low-voltage localiser is self-contained with controls and terminals mounted on an earthed metal panel with a sensitive galvanometer, damage to which during out of balance is prevented by a shunt; a one-tenth range is provided by a switch to assist in localising faults close to the end of the faulty section. Heavy terminals are provided for the connections to the sound and faulty cores of the cable under test and separate terminals for the galvanometer connections which can be made directly to the cable. For normal tests correction for the resistance leads is unnecessary, but when long leads are employed or the highest accuracy is required, a simple correction to the reading can be made.

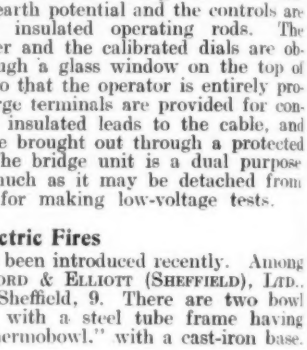
The accuracy of reading is dependent on the resistance of the fault and the supply voltage. The low-voltage model is suitable for use up to 600 V, at which an accuracy of 0.1 per cent. is stated to be obtained on faults up to 20,000 ohms resistance. For faults of a normal character, it is stated that 8 to 10 V is sufficient to obtain this accuracy.

The high-voltage fault localiser has been designed for investigating faults on cables where d.c. test voltages up to 50 kV have to be employed on account of the very high resistance of the fault to earth. For this purpose a low-voltage model is fitted into a metal box and supported at the centre of an expanded metal cage. The metal box is connected to the high voltage end of the supply so that the voltage across the various components of the bridge is negligible. In order to protect the galvanometer from surges (*e.g.*, as when the cable is arcing at the fault) an internal protection device is fitted.

The whole of the outer cage of the instrument is at earth potential and the controls are fitted with insulated operating rods. The galvanometer and the calibrated dials are observed through a glass window on the top of the panel, so that the operator is entirely protected. Large terminals are provided for connecting the insulated leads to the cable, and these can be brought out through a protected aperture. The bridge unit is a dual purpose model inasmuch as it may be detached from the cage and used alone for making low-voltage tests.

Electric Fires

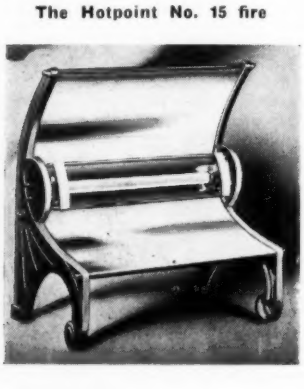
Several electric fires have been introduced recently. Among them is a range by DUNFORD & ELLIOTT (SHEFFIELD), LTD., Attercliffe Wharf Works, Sheffield, 9. There are two bowl fires, the "Chromobowl," with a steel tube frame having brazed joints, and the "Thermobowl," with a cast-iron base. A low-priced cast-iron non-reflector fire is the vitreous-enamelled "Torridbar." The "Radiastic," is a new light 1-kW portable reflector model, a similar 2-kW type being known as the "Flamostic." The chromium-plated reflectors of the 1-kW "Swivelglow" and the 2-kW "Flamoglow" are adjustable, and are mounted in a tubular frame.

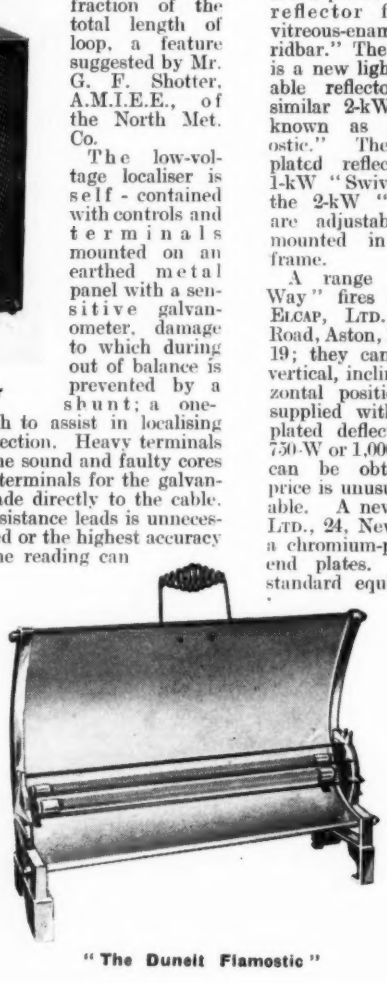


A new Siemens bathroom fitting

A range of "Three-Way" fires is made by ELCAP, LTD., 1, Lozells Road, Aston, Birmingham, 19; they can be used in vertical, inclined and horizontal positions and are supplied with chromium-plated deflectors. Either 750-W or 1,000-W elements can be obtained. The price is unusually low and a large number of finishes is available. A new fire by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1, is the No. 15, with a chromium-plated reflector and matt silver finished die-cast end plates. Six feet of three-core flex is provided as standard equipment and 750-W or 600-W loadings for the element can be supplied to order.

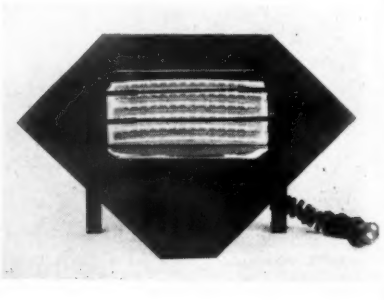
The Hotpoint No. 15 fire





"The Dunelt Flamostic"

An "Elcap" three-way fire



British Overseas Electrical Trade

Analysis of exports and imports during November

THE steady improvement over last year in our electrical exports which had continued since February was halted in November, when the total value (£1,324,218) fell short by £87,651 of that in the corresponding month of 1935. So far as the current year is concerned, the value of exports in November was second only to the October total, and as that month and November, 1935, contained twenty-seven and twenty-six working days, respectively, against twenty-five in the month under review, the position is not so bad as at first sight. Electrical imports, at £426,795, were £18,217 in advance of November, 1935, but this increase was less than in recent months.

The accompanying smaller table, compiled from figures abstracted from the November Board of Trade returns, shows that exports in the majority of classifications were of a lower value, the heaviest fall being in the case of telegraph and telephone apparatus other than radio. Foreign countries were mostly responsible for this, as the following analysis reveals (comparative values for November, 1935, are given in parentheses) :—

South Africa, £26,091 (£32,435); Australia, £24,691 (£33,930); Argentina, £19,736 (£12,637); Canada, £395 (£954); other British countries, £36,679 (£32,557); other foreign countries, £27,337 (£58,359).

The other major item in the goods and apparatus section—insulated wires and cables other than telegraphic and telephonic—shows a comparatively small decrease; indeed, exports of the rubber insulated variety were slightly higher (£102,558 against £100,712). The chief destinations of such exports are set out in the following analysis, with comparative figures for November, 1935, in parentheses :—

Rubber insulated wires and cables.—Australia, £27,867 (£27,106); South Africa, £27,342 (£20,627); British India, £17,460 (£20,868); New Zealand, £6,048 (£8,209); other British countries, £11,210 (£14,198); foreign countries, £12,631 (£9,704).

Electric wires and cables (insulation other than rubber).—Australia, £28,978 (£11,203); South Africa, £21,922 (£41,410); British India, £17,211 (£29,512); other British countries, £23,190 (£17,226); foreign countries, £11,638 (£12,226).

Although exports of radio apparatus as a whole were less in value, there was a satisfactory rise of £10,117 in parts and accessories shipped overseas, as compared with a decrease of £24,126 in similar apparatus imported.

The best feature of the month's trade was the rise of £45,235 in the value of generators shipped overseas. A good deal of this extra plant was sent to British India (+£52,025), and various smaller Empire countries also contributed to the improvement with an increase of £22,739. Moreover, Russia, which has practically ceased to be an importer of our electrical plant, reappears in this section, taking plant to the value of £6,741. Small generators accounted for a good deal of the increase, those of not more than 200-kW sent abroad totalling 251 tons against 128 tons in November, 1935. Larger plant aggregated 642 tons as compared with 420 tons.

Exports of motors were 621 tons against 827 tons in the corresponding month of last year, while shipments of other machinery, such as transformers and switchgear, were also substantially lower, especially those to South Africa.

On the other hand,, imports of machinery increased in value by £22,057. There was also a material rise in imports of lighting apparatus and of unenumerated electrical goods.

The chief sources from which electrical equipment was obtained, with comparative figures, were as follows :—

Electrical goods and apparatus.—United States, £115,183 (£121,269); Germany, £81,716 (£79,280); Netherlands, £51,132 (£63,590); Belgium, £22,807 (£15,324); Switzerland, £15,864 (£18,621); Austria, £12,538 (£9,487); France, £9,928 (£9,297); other foreign countries, £38,897 (£34,180); British countries, £14,856 (£12,921).

Electric vacuum cleaners.—United States, £7,647 (£5,115); Canada, £1,810 (£5,883); Germany, £1,512 (£986); Sweden, £1,396 (£3,533); other foreign countries, £2,114 (£1,726).

In the eleven months to the end of November the total value of electrical exports was £13,439,099 against £12,449,904 in the corresponding period of last year, representing an increase of 8 per cent., while imports were £3,978,405 against £3,381,444, an increase of 18 per cent.

EXPORTS AND IMPORTS DURING NOVEMBER

	Exports. Nov. 1936.	Exports. Inc. or dec. compared with Nov., 1935.	Imports. Nov. 1936.	Imports. Inc. or dec. compared with Nov., 1935.
Submarine telegraph and telephone cables	£1,580	+ £1,302	*	—
Telegraph and telephone wires and cables (not submarine)	48,176	— 3,567	*	—
Other insulated wires and cables	205,497	— 6,792	£36,563	+ £7,349
Radio receivers, not radiograms (excluding valves)	31,390	— 13,710	27,711	— 7,649
Radio transmitters (excluding valves)	17,903	— 8,020	*	—
Radio valves	41,930	— 13,606	25,054	— 901
Other radio parts and accessories	51,604	— 10,117	72,312	— 24,126
Telegraph and telephone apparatus (other than radio)	134,929	— 35,943	*	—
Electric carbons	*	—	12,298	+ 4,033
Incandescent lamps	48,787	— 9,091	18,580	+ 2,229
Other lighting apparatus	41,450	— 2,841	61,061	+ 12,412
Primary batteries	15,464	— 3,512	681	+ 513
Accumulators	59,222	+ 6,321	*	—
House service meters	15,940	— 3,343	*	—
Other electrical instruments	21,460	+ 2,835	22,274	— 7,997
Unenumerated electrical goods and apparatus	131,673	— 12,001	86,387	+ 13,089
Electric generators up to 200 kW	42,420	— 13,472	*	—
Electric generators over 200 kW	117,829	— 45,235	*	—
Electric motors	89,775	— 13,083	29,082†	+ 11,878
Convertors and transformers	63,527	— 26,573	*	—
Starting and controlling gear for motors	32,189	— 18,104	*	—
Switchgear	100,387	— 3,484	*	—
Other electrical machinery	11,026	— 397	20,310	+ 10,179
Electric vacuum cleaners	*	—	14,482	— 2,792
Total	£1,324,218	— £87,651	£426,795	+ £18,217

* Not classified separately. † Not railway and tramway motors.

BRITISH ELECTRICAL EXPORTS DURING NOVEMBER

Destination.	Goods and apparatus, Nov., 1936.	Inc. or dec. compared with Nov., 1935.	Electric generators, Nov., 1936.	Inc. or dec. compared with Nov., 1935.	Electric motors, Nov., 1936.	Inc. or dec. compared with Nov., 1935.	Other electrical machinery, Nov., 1936.	Inc. or dec. compared with Nov., 1935.
Irish Free State	£58,109	— £14,438	*	—	*	—	*	—
Channel Islands	19,330	+ 1,841	*	—	*	—	*	—
Union of South Africa	142,064	— 16,453	£24,898	+ £2,964	£20,870	— £9,083	£60,392	— £60,741
British India	104,435	— 18,374	74,723	+ 52,025	15,810	— 2,760	40,043	— 3,888
British Malaya	26,701	+ 10,148	*	—	*	—	11,140	+ 6,256
Ceylon	6,988	— 1,148	*	—	*	—	*	—
Hong Kong	25,118	+ 9,077	*	—	*	—	*	—
Australia	125,961	+ 15,723	6,812	+ 1,053	10,150	— 7,575	7,076	— 9,136
New Zealand	43,571	— 1,512	*	—	5,464	+ 986	19,720	+ 8,925
Canada	8,370	+ 928	528	— 13,947	4,694	+ 226	5,271	+ 3,029
Other British Countries	48,015	— 9,019	32,327	+ 22,739	10,600	— 329	22,678	+ 9,079
Sweden	19,553	— 2,622	*	—	*	—	*	—
Denmark	11,494	+ 3,341	*	—	*	—	*	—
Netherlands	16,889	— 1,156	132	+ 35	*	—	1,492	+ 480
Belgium	11,049	— 9,248	*	—	*	—	*	—
France	13,445	— 752	*	—	*	—	3,448	+ 1,108
Portugal	6,062	— 2,266	*	—	*	—	*	—
Spain	372	— 6,944	*	—	*	—	*	—
Italy	1,773	— 6,757	*	—	*	—	*	—
Greece	5,631	+ 91	*	—	*	—	*	—
Rumania	6,343	+ 3,641	*	—	*	—	*	—
Egypt	7,030	— 1,062	*	—	*	—	1,206	+ 915
China	12,278	— 22,445	*	—	*	—	2,060	+ 854
Brazil	16,206	+ 6,631	*	—	*	—	*	—
Argentina	42,611	+ 3,029	*	—	3,072	— 400	2,402	— 1,030
Soviet Union	*	—	6,741	+ 6,741	125	— 125	*	—
Other Foreign Countries	87,667	— 24,971	14,088	— 12,903	18,990	+ 5,727	30,201	— 5,309
Total	£867,065	— £84,717	£160,249	+ £58,707	£89,775	— £13,083	£207,129	— £48,558

* Not classified separately.

Radio Apparatus in Poland

The formation has recently taken place in Warsaw of Warszawskie Towarzystwo Akceptacyjne, with a capital of 2,000,000 zlotys, the object of which is to finance the sale of radio apparatus.

Peruvian Trade Recovery

THE recovery in Peru's foreign trade in 1933 has continued progressively and was in 1935 again reflected in increased imports of electrical apparatus and appliances. Their total value in that year, at 6,642,000 soles (£=17-20 soles) was rather more than three times the level of 1932. The United States was credited with over half this business, Germany coming next (with 1,053,000 soles), while Canada's share (321,000 soles) was rather more than that of the United Kingdom. The value of Japan's electrical trade with Peru last year was 132,000 soles, as compared with only 8,000 soles in 1932.

From the following statement showing the values of imports of the leading lines, with a note of changes compared with 1934, it will be seen that noteworthy increases took place in imports of cable and wire, radio and telegraphic apparatus, and in cooking and heating appliances. Heavy electrical plant seems to be included in the group "machinery for industry." Here considerably increased trade is also shown, although the share of the United Kingdom declined. A new commercial agreement between Peru and the United Kingdom was signed in October. It provides for reciprocal most-favoured nation treatment, while Peru undertakes to accord "benevolent treatment" to public utility and other undertakings in the country in which British capital is invested.

	1935. Soles (Thous.)	Inc. or dec. Soles (Thous.)
Switches, circuit-breakers and similar accessories—		
Total	321	+ 20
From Germany	108	+ 21
„ Italy	19	− 2
„ United States	142	+ 22
„ United Kingdom	18	− 19
„ Japan	19	+ 7
Accumulators and batteries—		
Total	270	− 20
From Germany	16	− 4
„ United States	205	+ 2
„ United Kingdom	12	− 14
„ Japan	17	+ 5
Insulators—		
Total	46	− 19
From United States	22	− 4
„ United Kingdom	7	− 10
„ Germany	14	− 2
Insulated wire—		
Total	324	+ 64
From Germany	131	+ 39
„ United States	108	+ 45
„ United Kingdom	7	− 10
„ Holland	11	− 1
Telegraph apparatus—		
Total	169	+ 142
From United States	44	+ 24
„ United Kingdom	17	+ 13
Telephone apparatus—		
Total	165	− 27
From Belgium	114	− 37
„ United States	13	− 5
„ United Kingdom	27	+ 9
Wireless-telephone apparatus—		
Total	1,660	+ 740
From Germany	14	+ 4
„ United States	1,541	+ 731
„ United Kingdom	81	− 10

	1935. Soles (Thous.)	Inc. or dec. Soles (Thous.)
Cooking and heating apparatus (including industrial)—		
Total	800	+ 530
From Germany	107	+ 100
„ United States	605	+ 333
„ United Kingdom	2	− 2
„ Switzerland	65	+ 43
Unspecified electrical goods—		
Total	92	− 21
From United States	56	− 4
„ Sweden	3	− 12
Cable—		
Total	835	+ 535
From Germany	170	+ 140
„ United States	116	+ 95
„ United Kingdom	51	+ 24
„ Italy	216	+ 54
Flexible—		
Total	52	+ 6
From Germany	36	+ 11
„ Italy	1	− 1
„ United Kingdom	3	+ 1
Insulating tape—		
Total	26	+ 5
From Germany	5	+ 1
„ United Kingdom	2	+ 1
„ United States	17	+ 3
Ammeters, galvanometers, etc.—		
Total	77	+ 20
From United States	49	+ 5
„ United Kingdom	6	+ 1
House current meters—		
Total	68	− 35
From Germany	57	+ 38
„ Canada	3	− 80
Lamps, up to 50 W—		
Total	200	− 40
From Germany	78	+ 21
„ United States	42	− 22
„ United Kingdom	8	− 1
„ Holland	18	− 5
„ Japan	44	− 22

	1935. Soles (Thous.)	Inc. or dec. Soles (Thous.)
Lamps, over 50 W—		
Total	215	+ 65
From Germany	63	+ 39
„ United States	74	+ 17
„ United Kingdom	8	− 1
„ Holland	60	+ 28
„ Japan	5	− 8
Magnetos—		
Total	24	− 25
From United States	22	− 19
Electro-magnetic apparatus (medical)—		
Total	68	+ 40
From United States	59	+ 38
„ Germany	8	+ 3
Fractional h.p. motors—		
Total	35	+ 5
From United States	30	+ 12
„ Germany	3	+ 2
Switchboards—		
Total	442	+ 83
From Germany	29	+ 22
„ United States	31	− 17
„ United Kingdom	20	− 4
„ Belgium	329	+ 72
Transformers—		
Total	146	+ 56
From Germany	35	+ 28
„ United States	65	+ 16
„ Switzerland	35	+ 12
Insulating tubes—		
Total	51	+ 21
From Germany	17	+ 5
„ United States	25	+ 15
Fans—		
Total	12	+ 6
From United States	7	+ 4
Machinery for industry (other than textile, agricultural, mining, meat-packing and printing)—		
Total	5,140	+ 1,300
From Germany	1,360	+ 204
„ United States	2,064	+ 697
„ United Kingdom	720	− 119

New Books

Telecommunications. By J. M. HERRING and G. C. GROSS. Pp. 544; figs. London: McGraw-Hill Publishing Co. Price 30/- net.

This is an authoritative work on the economic and service aspects of the telecommunication industries, that is, telephony, telegraphy and radio, as developed in the United States of America. Dr. Herring is Professor of Finance and Commerce in the University of Pennsylvania, and Mr. Gross is chief of the International Section of the Federal Communications Commission.

The first four chapters deal with the development of these industries in the United States, though some allusion is made also to development in other countries, notably in the case of submarine telegraphy where England has been so prominent. There are then three chapters on the financial side, revenue, expenditure and rate structure followed by a chapter discussing the relative advantages of competition, combination and co-ordination. Five chapters deal with the regulations and policy governing these communication services in the United States, one chapter with international regulations, and the final chapter with what has been done and what, in the opinion of the authors, has been left undone, towards the establishment of sound laws and regulations for telecommunications in America.

The information given is well documented, and there is a good index. The book is a comprehensive study of American communications, and should prove valuable to those who are connected in an administrative capacity with communication services in this country, as well as in America.

Die Transformeratoren. By I. L. LA COUR and K. FAYE-HANSEN. (Third edition). Pp. 699; figs. 535. Berlin: J. Springer. Price Rm. 48.

The Arnold-la Cour *Wechelstromtechnik* series has been world famed for almost thirty years. The volume under review, which deals with the theory, construction, design and operation of power and instrument transformers, represents a worthy addition to it.

The sections on fundamental theory are substantially unaltered, but have been extended to take account of modern developments, particularly concerning transient-voltage and current phenomena. A valuable feature is the inclusion of very recent work by Norinder on the stress distribution in transformer windings when subjected to voltage impulses.

The practical side of transformer construction is lavishly illustrated and principal data regarding thirty-three power transformers, ranging in capacity from 5 kVA to 44,000 kVA and for voltages from 0.28 to 165 kV, are tabulated. These include products of the principal American, Austrian, British, German, Swedish and Swiss manufacturers, but unfortunately not French and Belgian. They cannot be classed as absolutely modern since, for example, Metropolitan-Vickers products are illustrated by single-phase shell-type groups which, although of excellent design, are of a class which was used some ten years ago in this country, but which has given place to core designs.

Transformers for special purposes are illustrated by reference to rotary-convertor and rectifier transformers, and to transformers for high currents (furnace transformers) and high voltages (testing transformers). Separate chapters cover voltage and current transformers for measuring purposes and with series transformers and reactance coils. The fundamental principles of the Buchholz protective relay are clearly described. A short concluding section—somewhat sketchy—deals with the transport, installation and maintenance of transformers.

The value of the book would have been increased by more detailed descriptions of on-load ratio-changing equipment and more information on non-inflammable filling media for transformers. The printing, figures, binding and indexing are of a high standard.

The Theory of Dimensions and its Application for Engineers. By F. W. LANCHESTER, LL.D., F.R.S. Pp. 314. London: Crosby Lockwood & Son. Price 12s. 6d.

While Dr. Lanchester writes with the primary object of enabling the young engineer to acquire a sound knowledge of dimensional theory, this is a book which should be closely studied by every engineer. In it will be found an interesting and very readable exposition on the text, the author's axiom, "that no one physical entity can rightly have assigned to it more than one dimensional value or expression" and, although the reader may not wholly agree with the strictures passed on current usage he will certainly be impressed by the risks attached to departures from well established systems.

In addition to explaining very fully the arguments in favour of the recognised physical units, the author deals with other

systems which are in use or have been proposed whereby the idea of mass length and time as the fundamental units has been modified, and he shows the fallacy or mistake in each case.

Numerous practical applications are worked out to show not only the operation of the theory of dimensions but also its use in the elucidation of problems. For example, it is shown that the h.p. rating rule for motor cars is scientifically based and the fact that h.p. varies with area is a general rule.

Electrical engineers will be especially interested in the several chapters dealing with different systems of electrical units and in the author's arguments in favour of the electromagnetic units and dimensions. As this is a matter of considerable controversy at the present time, this volume can be recommended to those interested for its clear and comprehensive treatment of the subject.

Parliamentary News (BY OUR SPECIAL REPORTER)

New Parliamentary Bills

We publish below a list of proposals of an electrical nature which will come forward in the ensuing session of Parliament. Readers who are desirous of obtaining further information will find the notices published in the *London Gazette* for December 4th and 8th.

Rochdale, Huddersfield, Newcastle-under-Lyme and Ilford Corporations.—Further powers in relation to their respective electricity undertakings.

Hastings Corporation.—Powers with respect to the purchase in certain circumstances of the undertaking of the Hastings Tramway Co., and further powers in connection with the electricity undertaking.

Wessex Electricity Co., the Lancashire Electric Power Co., and the North Devon Electric Power Co.—Further powers.

Isle of Thanet Electric Supply Co., Ltd.—To synchronise the dates of purchase of the several portions of the electricity undertaking; to make new provision with respect to the purchase of the whole of the undertaking; and for other purposes.

North Metropolitan Electric Power Supply Co.—To transfer to the company the undertakings of the Harrow Electric Light & Power Co., Ltd.; to make new provisions as to the rights of purchase of the Harrow U.D.C.; and for other purposes.

Sheffield Corporation.—To construct additional tramways; further powers in respect of the electricity undertaking; and for other purposes.

London Passenger Transport Board.—To provide certain services of trolley vehicles, and for other purposes.

Tapping Trunk Road Lighting Cables

On December 16th Mr. Mathers asked the Minister of Transport if he would state whether it would be his policy to allow electric cables used in connection with the lighting of trunk roads to be tapped for local street lighting in adjacent villages, and for household lighting and other purposes in such villages and farms near by.

Captain Hudson said that there was no reason why cables used for street lighting should not, if they were of sufficient capacity, be tapped for other purposes. This was within the discretion of the supply authorities concerned.

The West Midlands J.E.A.

Colonel Baldwin-Webb asked the Minister of Transport whether his attention had been drawn to the high charges for electrical energy for power purposes demanded by the West Midlands Joint Electricity Authority, the majority of the members of which were representatives of the local authorities, and of which the largest representation was that of the Wolverhampton Corporation; was he aware that that Corporation was quoting rates for electrical energy substantially below those quoted by the West Midlands Authority, and that, as a consequence, industrialists were being attracted to Wolverhampton from the distressed areas in Shropshire; and what steps he proposed to take to deal with the situation.

Captain Hudson said that the Minister was aware that the power charges of the West Midlands J.E.A. were somewhat higher than those in the neighbouring undertaking of the Corporation of Wolverhampton. Lest Col. Baldwin-Webb should draw any wrong inference from that fact, he would explain that the Authority's undertaking had only been established for a few years and covered a large area which was mainly rural, whereas Wolverhampton had a large and long established undertaking operating in a densely populated area. The Authority's Order provided that the terms for high-voltage power supplies should, failing agreement, be fixed by arbitration and the matter was one in which the Minister had no power to intervene. He was, however, informed that the Authority hoped to be able to reduce its charges in the near future.

Firedamp in Mines

On December 17th Mr. T. Williams asked the Secretary for Mines whether he had yet set up the committee to watch the progress of the Firedamp Detector Regulations, 1935; and, if so, would he state the personnel and when they would commence their sittings.

Captain Crookshank said he was setting up a committee with terms of reference to inquire into the working of the Regulations, and to make recommendations. The members of the committee would be Messrs. F. H. Wynne, C.B.E., H.M. Deputy Chief Inspector of Mines; W. Frowen, general secretary to the General Federation of Colliery Firemen's, Examiners' and Deputies' Associations; H. Hicken, secretary to the Derbyshire Miners' and By-Product Workers' Union; G. P. Hyslop, mining engineer; and A. E. Naylor, manager of Shirebrook Colliery. Mr. Isaac Foot, one of his predecessors in office, had agreed to act as chairman. No arrangements had yet been made with regard to the date on which the committee would commence its sittings, but there would be no avoidable delay.

Interference with Broadcasting

Captain Plugge asked the Postmaster-General whether his attention had been called to the effect on television sets of radio interference from petrol engines using electrical contrivances; and whether he would consider the introduction of legislation making it compulsory for electrical gear of any kind to be fitted with the necessary radio noise-suppressors.

Sir W. Womersley, Assistant Postmaster-General, said he was aware of the liability to interference with television reception from the source mentioned. A committee appointed by the Institution of Electrical Engineers had recently investigated the subject and had recommended that statutory powers should be sought. The committee's recommendations were at present under consideration.

In the Courts

Radio Patent Action

Mr. Justice Luxmoore, in the Chancery Division on December 17th, continued the hearing of the action brought by the British Thomson-Houston Co., Ltd., Marconi's Wireless Telegraph Co., Ltd., and Electric & Musical Industries, Ltd., against the Guildford Radio Stores and E. K. Cole, Ltd., for an injunction (and the usual ancillary relief) to restrain them from infringing the plaintiffs' letters patent No. 248731 and granted to the first-named plaintiffs for an invention for "Improvements in thermionic valve amplifying systems" for use in connection with radio receiving apparatus. The second and third plaintiffs were tenants in common in the patent.

The defence was a denial of the alleged infringement and a plea that the plaintiffs' letters patent were invalid by reason of prior publication and prior common general knowledge. Defendants counterclaimed for revocation of the letters patent. During the trial, which lasted several days, a great volume of technical evidence was given by experts called on both sides.

When the Court rose the hearing was adjourned until next term as Mr. Trevor Watson, K.C., found it impossible to conclude his reply on behalf of the plaintiffs. His Lordship intimated that the learned Counsel must have ample time to complete his argument.

B.T.H. Co. v. Crompton Parkinson

In the Chancery Division on December 17th Mr. Kenneth Swan, K.C., applied to Mr. Justice Luxmoore for a day to be fixed for the hearing of a patent action brought by the British Thomson-Houston Co., Ltd., against Crompton Parkinson, Ltd.

Mr. Swan stated that the action concerned the frosting of incandescent electric lamp bulbs and was expected to occupy the Court for a considerable time. There had been several hundreds of experiments carried out during the past three years and there would be a great number of exhibits in the case. Besides the expert witnesses to be called there would be the evidence of a number of workmen and people in a responsible position engaged in the manufacture of lamps with regard to the issue of alleged prior user and methods of lamp manufacture. It would be very convenient to the parties and everybody concerned if it could be known when the action was likely to come on for hearing.

Sir Stafford Cripps, K.C., supported the application and after some discussion his Lordship, while regretting that he could not definitely fix a date for the hearing, decided that the trial should not commence before January 25th next subject then to any case part heard.

Theft of Electricity

At the Shrewsbury Police Court last week Edward H. Digwood, electrician, was charged with fraudulently using electricity, the property of the Shrewsbury Corporation. Evidence was given that when a meter inspector visited defendant's business premises he found that by means of two safety pins and fuse wire the lighting and power meters had been entirely cut out. On a battery charging board, which was in use, were eight batteries, while five more were standing by.

A police sergeant stated that defendant admitted tapping the wires. He said that he had bad financial difficulties and that he was willing to pay for the current.

Digwood pleaded guilty and expressed his regret. The chairman of the Bench said that they regarded it as a serious offence, but in view of his previous record bound him over for six months, and he would also have to pay £1 17s. 6d. costs.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The B.I.F., London

The general improvement in trading conditions as reflected in the large increase in the number of exhibitors of electrical and allied goods at the London Section of the British Industries Fair, which is being held at Olympia from February 15th to 26th. Stands of electrical interest, about seventy, will number nearly half as many again as at last February's exhibition and, as usual, they will cover the smaller and more "domestic" goods, the heavier exhibits continuing to be displayed concurrently at the Engineering and Hardware Section of the Fair at Castle Bromwich, Birmingham. Below appears a list of those manufacturers who have taken space at Olympia, and we shall be pleased to hear from further prospective exhibitors.

Air-Glow Lights, Ltd.
Aladdin Industries, Ltd.
Allen & Hanburys, Ltd.
Ashdown, H. E., (Birmingham), Ltd.
"Attracta" Electrical Co.
Baird Television, Ltd.
Bakelite, Ltd.
Belgrave Electric Co., Ltd.
Bellingham & Stanley, Ltd.
Binger, O. D., (Sales Aids), Ltd.
British Electric Domestic Appliances, Ltd.
British Plastics Federation, Ltd.
British Vacuum Cleaner and Engineering Co., Ltd.
Brook, J. A., Ltd.
Bylock Electric, Ltd.
Cable & Wireless, Ltd.
Chance Bros. & Co., Ltd.
Cole, E. K., Ltd.
Crayonne, Ltd.
Dent, R. H., Ltd.
De la Rue, Thomas, & Co., Ltd.
Dernier & Hamlyn, Ltd.
Electric Art Shades (1928), Ltd.
Dictograph Telephones, Ltd.
Dominion Electrical Co.
Eastick, J. J., & Sons.
Ebonestos Insulators, Ltd.
Elliott, F. W., Ltd.
Foote, Richard W., Ltd.
Garrard Clocks, Ltd.
General Chemical & Pharmaceutical Co., Ltd.
General Mouldings Co., Ltd.
Gestetner, D., Ltd.
Gledhill, G. H., & Sons, Ltd.
Guiterman, S., & Co., Ltd.
Hanovia, Ltd.
Heayberd, F. C., & Co.
Hoover, Ltd.
Hughes, F. A., & Co., Ltd.
Ideal Home Electrical Appliances, Ltd.
Illuminated Amusements, Ltd.
Imperial Chemical Industries, Ltd.
Injection Moulders, Ltd.
Insulators, Ltd.
Johnson, Matthey & Co., Ltd.
Kent Mouldings.
K.F.M. Engineering Co., Ltd.
Knightshades, Ltd.
Lister, R. A., & Co., Ltd.
Lusty, W., & Sons, Ltd.
Marconi-Ekco Instruments, Ltd.
Mayfair Shades, Ltd.
Mouldrite, Ltd.
Multitone Electric Co., Ltd.
New Radiant, Ltd.
New Welbeck, Ltd.
Norma Technical Products, Ltd.
Philco Radio & Television Corporation of Gt. Britain, Ltd.
Phœnix Telephone & Electric Works, Ltd.
Smith's English Clocks, Ltd.
Synchrophone (1936) Co.
Synplas, Ltd.
Thermega, Ltd.
Tintometer, Ltd.
Twentieth Century Electrical Vactric, Ltd.
Vulcanised Fibre, Ltd.
Waite & Son, Ltd.
Watson, W., & Sons, Ltd.
Wright & Weaire, Ltd.

The New Paramount Dance Salon

The Paramount Salon de Danse, Tottenham Court Road, which was opened recently, has accommodation for 1,000 dancers, diners and onlookers. Built in stadium form, the hall has a modified balcony raised several feet from the dance-floor level, with built-in settees for diners. One of the features of the Salon is the staging of cabarets, for which a number of original ideas have been introduced. One takes the form of a circular rostrum in the dance floor, which can be raised to a sufficient height to allow artists to be seen by everyone in the hall. A considerable amount of electrical equipment has been included in the decorative and constructional layout. Air-conditioning plant has been installed by Young, Osmond & Young, Ltd., while spot and batten lighting has been provided by the Strand Electric and Engineering Co., Ltd. The cornice lighting is by the Berkeley Electrical Engineering Co., Ltd., the contractors for the electrical installation of the Salon. Other lighting fittings in the hall are by the G.E.C., the fittings in the entrance hall being by Best & Lloyd. The motor for lifting and revolving the platform in the centre of the floor was supplied by Knight & Co., who were also responsible for the control gear installed in the operating box. A Siemens inter-communication telephone system has been installed, while other electrical apparatus includes Henley cable, G.E.C. tubing, "Ediswan" lamps, Simplex distribution boxes, and Crabtree & Tucker switches. The main switchgear is by Sanders & Co. The main arc board for projectors and the stage lighting board were supplied by the Major Equipment Co. Effective use is made of neon signs on the exterior of the Salon, and these were supplied by Boro' Signs.

Industrial Lighting

The latest number of the "Reflector," published by the Benjamin Electric, Ltd., contains well-illustrated notes on a number of industrial lighting installations in which the company's equipment is used. These include a swimming pool, a motor car factory, dog-racing tracks, a printing works and a cinema studio. In the case of the last mentioned the company asks us to point out an error. The installation was not carried out by the British Electric and Manufacturing Co., Ltd., who are factors and supplied the reflectors, but by the electrical staff of Warner Bros. Studios, Ltd.

Employment in November

Employment during November showed further improvement and was very good in electrical engineering. The *Ministry of Labour Gazette* states that the total out of work in the engineering industry was 64,365, or 6.1 per cent., a decrease of 0.4 per cent. as compared with October and comparing with 10.3 per cent. in November, 1935. In the electrical engineering section the number of unemployed was 3,416, the percentage falling slightly from 3.6 to 3.4 (5.6 per cent. in November, 1935). The unemployed in the electrical wiring and contracting industry numbered 3,527 or 9.2 per cent., as against 12.6 per cent. in November, 1935. In the electric cable, apparatus, lamps, &c., group the unemployed increased to 7,809, or 5.1 per cent. (8.2 per cent. in November, 1935).

All-India Radio Merchants' Association

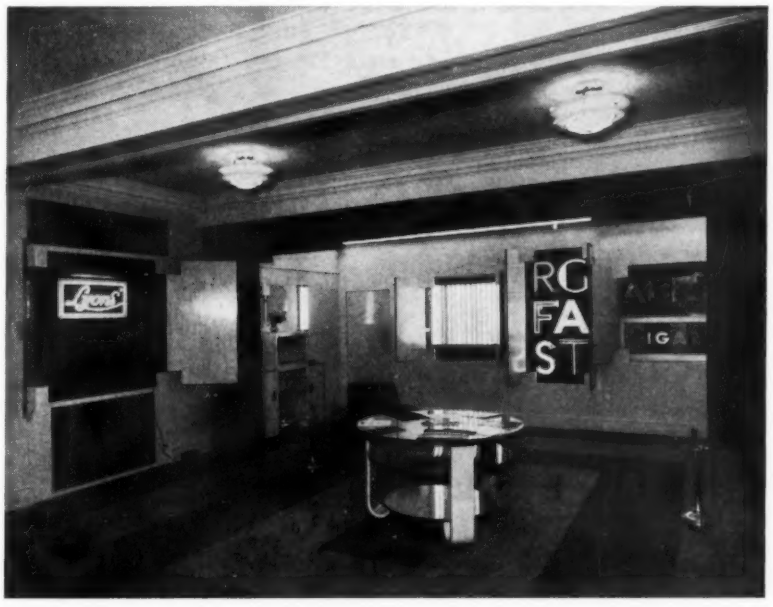
An All India Radio Merchants' Association has been inaugurated in Bombay under the presidency of Sir Rahimtoola M. Chinoy, to serve the interests of the radio trade and to help the general public to buy with confidence equipment of the most favourable type for Indian requirements. According to the president, the first step the Association will take will be to agitate for the revision of the duty on receiving apparatus with a view to encouraging set manufacturing in the country.

[*Elec. Rev.* photos.

The exterior and the main hall of the New Paramount Salon de Danse, Tottenham Court Road, W.C.

A New Sign Showroom

Special facilities for the display of a wide range of electric signs, neon tubing and the increasingly popular "Spectrum" lighting are provided by the new showroom which the Franco-British Electrical Co., Ltd., has just opened at 25, Oxford Street, London, W.1. Furnished in modern design in green, buff, black and fawn, the new showroom is in two sections separated by thick curtains, which can be drawn right back if desired. The smaller section is intended largely for showing applications of "Spectrum" lighting (an attractive combination of different coloured neon tubes concealed behind special diffusing glass screens) for cornices, wall brackets, and for show cases. Let into the sycamore veneered walls all round the showroom is a series of panels (all of which have doors) and in these are placed typical examples of signs, neon lettering, &c. One particularly interesting display enables the demonstration and comparison of fifteen of the company's neon types, including a number of the new types, which by the use of a fluorescent powder deposited on the glass are available in many pleasing colours not hitherto possible. Portable alcoves are situated in two of the corners for showing various types of traffic signs, and a special showcase is ready to receive special displays for the Coronation as soon as the final designs are decided upon.



[Elec. Rev. photo.

The new showroom of the Franco-British Electrical Co., Ltd., at 25, Oxford Street, London

An Illumination Course in Glasgow

A total of 1,305 persons, an average of 218 persons per lecture, attended a "progress" course held by the Electric Lamp Manufacturers' Association's Lighting Service Bureau of Scotland during October and November at the Royal Technical College, Glasgow. The course was successful from every point of view, and those who attended included representatives from all branches of the electrical industry, as well as engineers, shipbuilders, ironmongers and others. The subjects dealt with included "Modern Methods of Illumination Design" (Mr. T. Catten), "The New Science of Seeing" (Mr. W. J. Jones), "Modern Industrial Lighting" (Mr. J. W. Howell), "Electric Discharge Lamps" (Mr. L. J. Davies), "Engineering Aspect of Architectural Lighting" (Mr. H. Lingard), and "The Retail Shoplighting Market" (Mr. T. Catten).

An "Xcel" Window Sign

A novel neon-effect advertising sign is now being issued by Elexcel, Ltd. It comprises a metal lamp box arranged to accommodate a loose panel containing the words "Xcel Electric Appliances" attractively printed in green and red on a blue ground. The outline of the familiar trade-mark and the centre of the remainder of the lettering is brilliantly illuminated immediately the standard type lamps in the lamp-box are switched on. The sign is constructed to enable the company to insert the individual names of dealers displaying it, in illuminated letters immediately above the message. Retailers can make use of the sign in several ways; it can be suspended by chains centrally towards the top of the window; the loose panel can be reversed and the sign stood as a footlight on the floor of the window to floodlight the products; or it can be further used by mounting it on top of any one of the series of printed display pieces issued to popularise "Xcel" products.

The new window sign which is being distributed to dealers by Elexcel, Ltd.

Trade Announcements

The branch of the British General Electric Co., Ltd., at Auckland, New Zealand, has been removed from Brunswick Buildings, High Street, to 26, Customs Street East, Auckland.

Asea Electric, Ltd., is removing on December 28th to Fulbourne Road, Walthamstow, E.17. (Telephone: Larkswood 2350. Telegrams: Autosyncro Walt London).

The Aluminium Protection Co., Ltd., has removed to larger premises at Dialumin Works, Brentfield Road, Willesden, N.W.10 (telephone: Willesden 4416-7).

The Colliery Department and sales office of Callender's Cable & Construction Co., Ltd., in Sheffield has removed to 36, Arundel Street. The sales office in Belfast is now at 26, Howard Street.

Calendars, Diaries, etc.

Bull Motors have issued a calendar this year for the first time. It is surmounted by a cut-out in gilt and black of a bull's head, and bears illustrations of two of the company's motors. The monthly sheets also show the calendar for the preceding and following months.

Illustrations showing the changes which have occurred during the past hundred years appear on the calendar of Blackstone & Co., Ltd., which has monthly sheets. The subjects illustrated vary from hansom cab and the modern car to the wind-driven mill and Blackstone oil engines.

A wintry scene entitled "In the Land of Hans Brinker" makes an attractive picture for the calendar of Accumulators of Woking, Ltd.

Peverill Castle, near Bakewell, makes a picturesque scene for the calendar of the D.P. Battery Co., Ltd.

For the calendar of the Fuller Accumulator Co. (1926), Ltd., "The Optimist" is depicted by A. J. W. Burgess as a salmon leaping from the water after a dainty morsel which is suspended out of its reach.

An attractive lady behind a cluster of daffodils adorns the calendar of the Hart Accumulator Co., Ltd.

The calendar of Lindsay & Williams, Ltd., has large daily tear-off slips with bold figures in red.

"Towing Down," by Sam J. M. Brown, showing a three-masted vessel being towed down to the sea makes an attractive picture for the calendar received from F. W. Brackett & Co., Ltd.

Illustrations of some of the company's products appear on the calendar of Ruston & Hornsby, Ltd., which has two months on each sheet.

Price & Belsham, Ltd., and the P. & B. Engineering Co., Ltd., have sent us a neat "no-fume" cigarette ash receiver in bakelite with an untarnishable metal top.

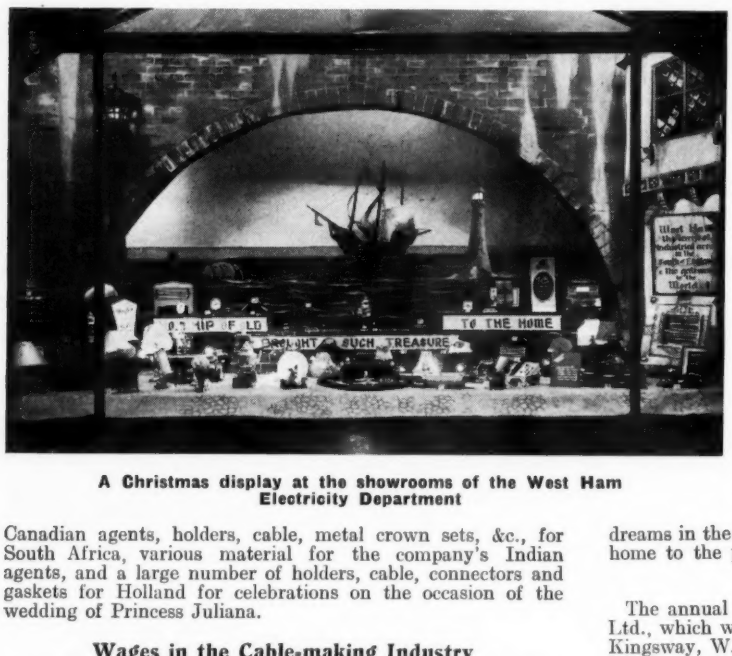
A refill for the calendar of Trefileries et Laminoirs du Hâvre has been received from Fernand Espir, Ltd., the general agents for Great Britain.

Orders Recently Booked

Orders recently received by the Brush Electrical Engineering Co., Ltd., for Diesel engines and Diesel electric sets include one, received through the Harland Engineering Co., Ltd., for two 260-b.h.p. Diesel engines for Weymouth Waterworks. A repeat order has been received from St. Mary's Electric Supply Co., Ltd., Scilly Isles, for one 160-b.h.p. Diesel engine complete with alternator, while another repeat order is for a 200-b.h.p. Diesel engine for Clovers, Ltd., flour mill, Halstead. Other orders received include marine auxiliary sets with remote control, consisting of three 160-b.h.p. Diesel engines with generators, for Louis Dreyfus & Co., Paris, a 100-b.h.p. Diesel engine for a flour mill at Maldon, and a

400-b.h.p. Diesel engine for a flour mill at Fingrinhoe, Suffolk.

The "Beeantee" Illuminations, Ltd., has received a number of orders for its products from abroad in connection with the Coronation celebrations and other events. These include large quantities of "Beeantee" holders, colour sprayed lamps, cable and metal crown set pieces for the Government of Southern Rhodesia, standard holders, miniature holders, connectors, cable, reflectors, and other material for its own Canadian agents, holders, cable, metal crown sets, &c., for South Africa, various material for the company's Indian agents, and a large number of holders, cable, connectors and gaskets for Holland for celebrations on the occasion of the wedding of Princess Juliana.



A Christmas display at the showrooms of the West Ham Electricity Department

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that the December 1st cost-of-living figure (51 per cent. above the 1914 level) will not involve any alteration in wages on the third pay day in January.

The People's Palace, Mile End

The People's Palace, Mile End, which was opened on December 12th, is an excellent example of modern theatre electrical practice. The decorative lighting fittings were supplied by David Assersohn, while super "Straight-Lite" fittings, incorporating "Maxtrip 2" lamps have been used for cornice lighting. The batten lighting, stage equipment, and switchboard were provided by the Strand Electric and Engineering Co., Ltd. Particular attention has been paid to the air-conditioning of the premises, and two plenum ventilating systems by Jeffreys, Ltd., have been installed. Secondary lighting is provided by D. P. batteries, while electrical accessories include Crabtree switches and Walsall switchplugs. Sanders switchgear is used for the main boards and fuse boards, and the intercommunication telephones were made by the Reliance Telephone Co., Ltd. Other electrical apparatus includes B.T.H. sound equipment, curtain controls by W. J. Furse & Co. (London), Ltd., G.E.C. tubing, and mercury-arc rectifiers by the Nevelin Electric Co., Ltd. Beneath the floor of the main hall a special lift has been installed by Evans Lifts, Ltd., which is used for transferring the seats below the floor and then raising the dance floor in sections into position. The electrical contractors were Electrical Installations, Ltd., and the consulting engineers were A. E. Mohring & Son.

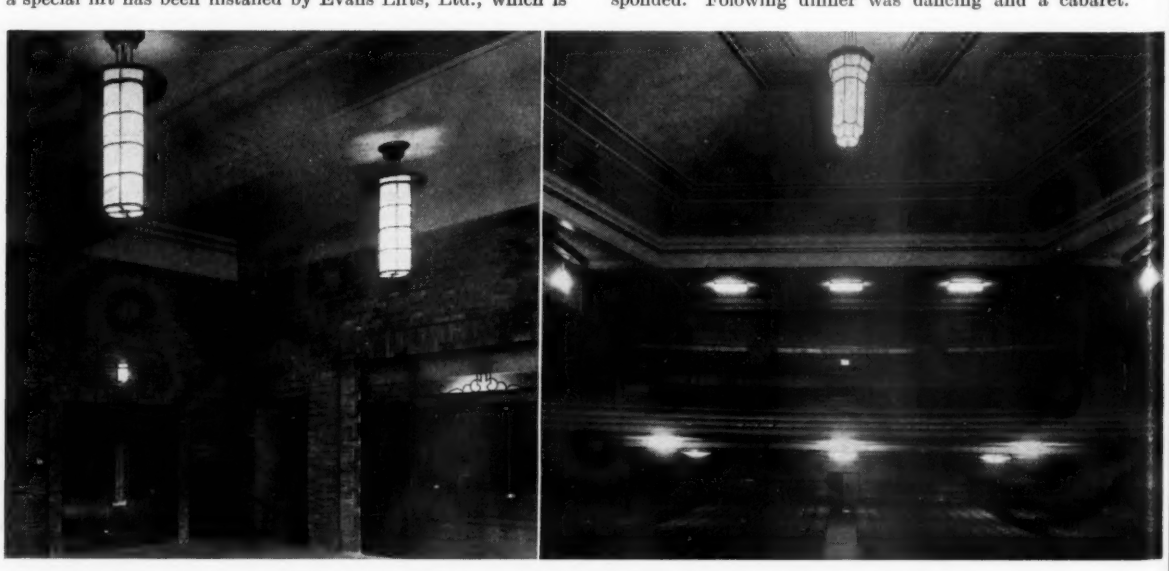
A Christmas Window Display

The accompanying illustration shows one of the window displays which the West Ham Corporation Electricity Department has arranged at its showrooms at 84, Romford Road. The ship, which is a model of an old "treasure ship," is in movement, as though in a rolling sea, and appears to be making for the harbour. The lighthouse is flashing and the whole piece is made up to represent a quayside. Play is made of the fact that West Ham is the largest industrial area in the South of England, and as the Victoria and Albert and the King George V Docks are at the south of the borough, West Ham is referred to in an inscription at the side as the "Gateway to the World."

The slogan "No ship of old brought such treasure to the home" effectively link the display piece with the electrical idea and the display of electrical gifts for Christmas. The display in the side window in Vicarage Lane shows an old-fashioned fireplace at which Cinderella is seated, and there is a shaped transparency (as though smoke from the fire) with fairy tale figures painted on the reverse. This and the scroll to the front (with the slogan "Don't be a modern Cinderella, electricity banishes drudgery and gives you leisure") are lighted from the rear. This lighting is operated by a "flasher" so that the appearance is given of Cinderella weaving dreams in the fire smoke, and the electrical message is brought home to the public.

Social Event

The annual Christmas Party of the Aron Electricity Meter, Ltd., which was held on Friday last at the Connaught Rooms, Kingsway, W.C., was one of those jolly informal functions in which speech-making plays but a small part, and practically the whole of the evening is given over to revelry. A large gathering of staff and friends sat down to an excellent Christmas dinner which reached its climax with the ceremonial course of Christmas pudding, served lighted-up, in the time-honoured manner. Ald. H. Kahn (chairman), in proposing the toast of the company, expressed regret at the absence of Col. R. E. Crompton, through a cold, remarking that Col. Crompton had been a grand figure in the company since its inception. A message was sent to him wishing him a speedy recovery. Mr. L. Freeman (general manager), who was to have proposed the toast of the guests, was suffering from loss of voice due to a cold, and Mr. Hills (general sales manager), who deputised for him, extended a warm welcome to the visitors. In responding, Mr. A. E. McKenzie (borough electrical engineer, Wimbledon) said that the company was going forward in leaps and bounds, and it was feeling the effect of the greatly increased use of electricity for all purposes. The toast of "The Staff" was proposed by Mr. P. Ashley Cooper (director), who said that they had a larger staff than at any time in the history of the company, while the past year had established records in output and turnover. These facts were more remarkable when they recalled the fire which occurred in January last. The advance was largely due to the hard work of the staff under the leadership of Mr. Freeman. Mr. Burrows (secretary) responded. Folowing dinner was dancing and a cabaret.



Two views of the People's Palace, Mile End, showing (left) the vestibule, and (right) the auditorium [*Elec. Rev.* photos.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, December 22nd: Copper bars (best selected), sheet and rod, £79, £2 inc. English pig lead, £29 5s., £1 5s. inc. Spelter, £18 17s. 6d., 6s. 3d. inc. English block tin, £233, £2 10s. inc.

Messrs. Edward Till & Co. report, December 22nd: India rubber, Para fine, 1s. 1d., ¼d. inc.

New Catalogues and Lists

D. Walter & Co., Ltd., 61/63, Lant Street, London, S.E.1.—A catalogue of Coronation lighting equipment.

G. Cohen & Co., Ltd., 600, Commercial Road, London, E.14.—A catalogue of modern second-hand power plant.

Gothic Electrical Supplies, Ltd., 23, Constitution Hill, Birmingham, 19.—A large 220-page illustrated catalogue has been issued giving details of almost every kind of electrical accessory, appliance and fitting in the domestic field.

Ensign Lamps, Ltd., Kent Street Works, Preston.—A catalogue of electric lamps of all kinds.

Strand Signs, 28, Floral Street, London, W.C.2, have issued two catalogues in connection with the Coronation, one printed in several colours showing fittings and the other dealing with floodlighting equipment.

Pilkington Brothers, Ltd., Sheet Works, St. Helens, have issued a booklet containing technical data about "Armourplate" and toughened glass.

Griffin & Tatlock, Ltd., Kemble Street, London, W.C.—A technical booklet dealing with gas equipment and gas detection apparatus, &c., for laboratories.

J. H. Holmes & Co., Ltd., Hebburn-on-Tyne.—Six pamphlets describing electrical equipment for printing presses prepared in connection with the printing exhibition.

Revo Electric Co., Ltd., Tipton, Staffs.—A leaflet illustrating and describing floodlighting fittings for the Coronation.

T.M.C. Harwell (Sales), Ltd., 233, Shaftesbury Avenue, London, W.C.2.—A leaflet describing a new pendulum indicator.

Bankruptcy Proceedings

H. C. Bridgman, 37, Canynge Road, Clifton, Bristol, lately 7, Abbey Road, Westbury-on-Trym, Bristol, electrical engineer.—This debtor applied for his discharge on December 17th at the Guildhall, Bristol. It was stated that the bankruptcy occurred in July, 1935. According to the debtor's statement of affairs the liabilities amounted to £931, but proofs actually lodged totalled only £202, the difference being due to the fact that a number of creditors had not proved their claims. The assets, which were estimated to produce £64, had only realised £30 and no dividend had been, or could be, paid to the unsecured creditors. The discharge was granted subject to twelve months' suspension.

A. Plotzker (known as G. A. Walsh), wireless dealer, 47, Woodstock Avenue, Golders Green.—This debtor, who failed last June, applied on December 15th at the London Bankruptcy Court for an order of discharge. The Official Receiver reported that the debtor attributed his failure and insolvency to law costs. The liabilities amounted to £195 and the assets realised 15s. 6d. The debtor's solicitor asked for an immediate discharge to be granted subject to his client submitting to judgment for £10 to be satisfied by a cash payment. Mr. Registrar Parton said he could not accede to that application and suspended the discharge for six months.

A. W. Harber, 1, Kathleen Place, Redditch, electrician.—The public examination herein was held at the Court House, Corporation Street, Birmingham, on December 16th. Debtor had returned ranking liabilities of £333 and a deficiency of £294. He attributed his failure to commencing business without capital, poor trade, losses on a bookmaking business, and misappropriations by an employé. The examination was provisionally closed.

A. H. Craig, 69, Kings Road, Walton-on-Thames, lately carrying on business at 698, High Road, Leytonstone, E.11, as wireless dealer, &c.—The first meeting of creditors herein was held at 29, Russell Square, London, W.C.1, on December 14th. According to the statement of affairs prepared by debtor there were ranking liabilities of £357 and net assets of 17s. 6d., leaving a deficiency of £356. Debtor attributed his failure to insufficient profits in the business to meet the overhead expenses. The case being a summary one was left in the hands of the Official Receiver, as trustee.

A. Schnittlinger (commonly known as Alec Davis), 64, Coborn Road, Bow, E., radio dealer.—This debtor applied for his discharge at the London Bankruptcy Court on December 16th before Mr. Registrar Kean. The Official Receiver stated that the failure was in March, 1935, the liabilities amounting to £129 and the assets had realised £16. The debtor attributed his failure to liabilities incurred on behalf of his son. The discharge was granted subject to a suspension of eighteen months.

J. Freedman (known as J. Freeman), formerly trading as Euston Radio and as Albion Electric Co., Lampeter Street, London, N.1.—When this debtor appeared at the London Bankruptcy Court on December 16th for her adjourned examination the Official Receiver stated that he had only just received certain accounts that the debtor had been ordered to produce. The liabilities in the case amounted to £2,250 and the assets to £73. Mr. Registrar Kean granted a further adjournment until January 13th, to allow the Official Receiver to go into the accounts.

S. J. Miles, radio and electrical engineer, 134, Queen Victoria Road, Coventry.—Last day for receiving proofs for dividend December 31st. Trustee, Mr. C. J. Band, 9-11, High Street, Coventry, Official Receiver.

F. V. Lambert (Lamberts), electrical contractor, 31, Harmer Street, Gravesend.—First and final dividend of 1s. 8d. in the £, payable December 29th at Balfour House, Finsbury Pavement, E.C.2.

D. L. Gibson (James Rush & Co., and the Hadrian Engineering Co.), wireless retailer and manufacturer, 31-33, Westgate Road, and Back Eldon Lane, Newcastle-upon-Tyne.—Application for discharge to be heard on January 20th at the County Court House, Newcastle-on-Tyne.

G. Ireland, electrical engineer, near the Oak Inn, Fambridge Road, Maldon.—Receiving order made December 10th on debtor's own petition.

E. Aveyard (Alpha Electric Co.), electrical engineer, 14, Arnold Avenue, Hyde.—Receiving order made December 9th on a creditor's petition.

G. F. Jenkins, electrician, 24, Browning Road, Enfield.—Receiving order made December 11th on debtor's own petition.

J. L. Sylvester, radio and electrical engineer, 58, Ellers Road, Harehills, Leeds.—Public examination January 12th at the County Court House, Leeds.

R. C. V. Radeglia, electric lamp dealer, 40, King William Street, E.C.—Trustee, Mr. C. B. Park, Bankruptcy Buildings, Carey Street, W.C.2, Official Receiver, released December 8th.

J. Eade (J. Eade & Son), electrical contractor, 48, New Road, Skewen, Glam.—Discharge suspended for three months until February 19th, 1937.

C. Armstrong-Lamb, electrician, 8, Clarendon Place, Hyde.—First and final dividend of 1s. 11½d. in the £, payable December 30th at the Official Receiver's Office, Byrom Street, Manchester.

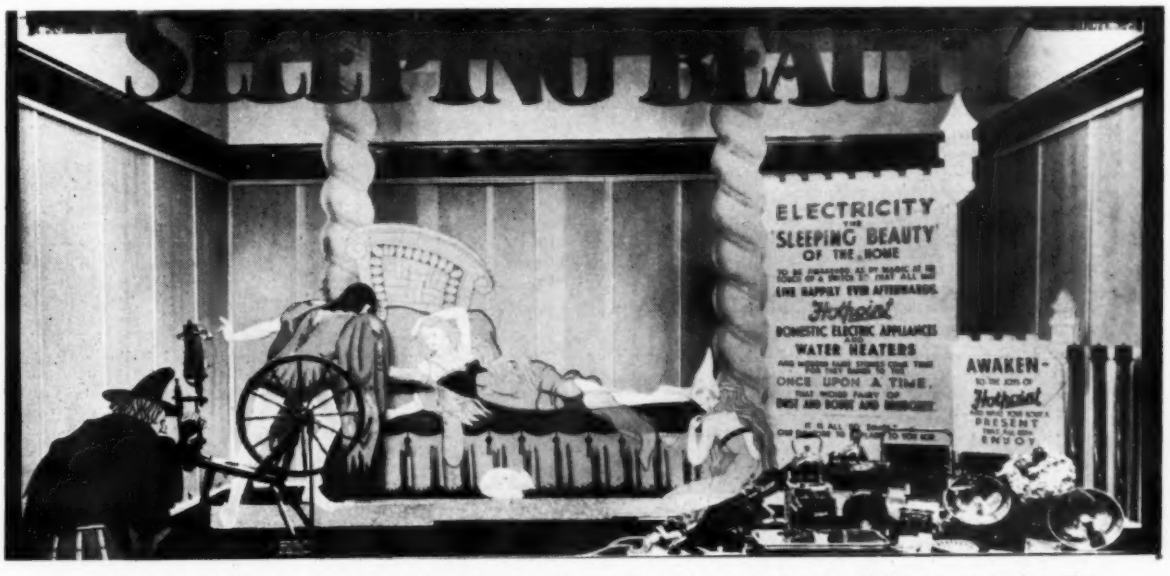
Company Liquidations

Newmode Electric Appliances, Ltd.—Winding up voluntarily. Liquidator, Mr. C. Collins, Crown House, Aldwych, W.C.2. Particulars of claims to the liquidator by January 2nd. This is a members' voluntary winding-up and all creditors have been, or will be, paid in full.

Brynland Electrical & Radio Co., Ltd.—Particulars of claims by January 11th to the liquidator, Mr. A. Collins, 28, Baldwin Street, Bristol.

Dissolution of Partnership

London Switches, manufacturers of small electrical organ parts and other businesses, 38, North Road, Islington, N.—Messrs. J. Christie and D. W. Beard have dissolved partnership. Mr. Christie will attend to debts and carry on the business.



A window display prepared by the Hotpoint Electric Appliance Co., Ltd., employing the Christmas pantomime idea

Electricity Supply

Lighting, Domestic, Power

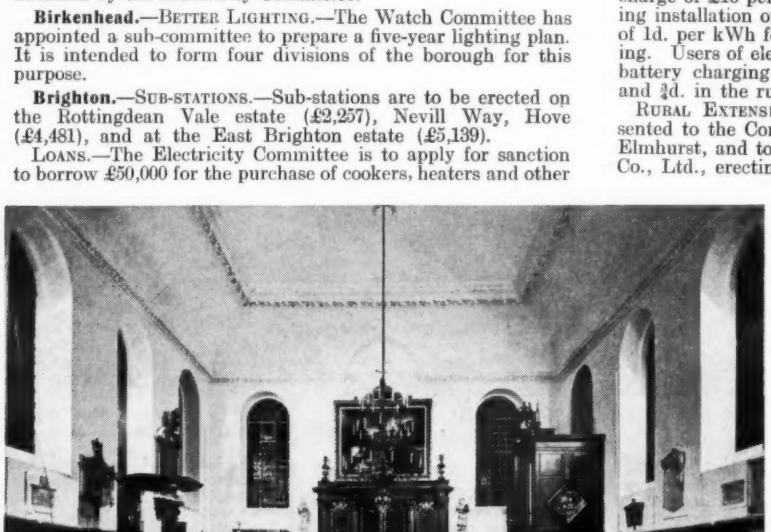
Auchtermuchty.—ELECTRIC STREET LIGHTING.—At its recent meeting the Town Council decided to install a number of electric street lamps. It was also agreed that, if the ratepayers in the burgh approved, more lighting by electricity would be introduced throughout the town.

Bedford.—DOMESTIC APPLIANCES.—Sanction to borrow £10,000 for domestic appliances for hire and hire-purchase has been obtained by the Electricity Committee.

Birkenhead.—BETTER LIGHTING.—The Watch Committee has appointed a sub-committee to prepare a five-year lighting plan. It is intended to form four divisions of the borough for this purpose.

Brighton.—SUB-STATIONS.—Sub-stations are to be erected on the Rottingdean Vale estate (£2,257), Nevill Way, Hove (£4,481), and at the East Brighton estate (£5,139).

LOANS.—The Electricity Committee is to apply for sanction to borrow £50,000 for the purchase of cookers, heaters and other apparatus to be let out on hire. Sanction has been obtained to loans of £5,000 in connection with high-voltage cables across Shoreham harbour; £100,000 for mains and services; and £20,000 for sub-stations and equipment.



A night photograph showing the new lighting at the Church of St. Michaels Royal, College Hill, E.C.

Brynamman (Carmarthenshire). — SUPPLY COMPANY ACQUIRED.—It was officially stated last week that the Brynamman and District Electric Supply Company has been acquired by the South Wales Power Company, subject to the approval of the Central Electricity Board. The Power Company is to take over the plant on January 1st.

Clitheroe.—MIDDOP SUPPLY SCHEME.—As the Settle Electricity Co. does not wish to give a supply to Middop, a scheme is to be prepared by the Council's electrical engineer and submitted to persons inquiring for a supply.

LOAN.—Application is being made by the Electricity Committee for sanction to borrow £1,500 for additional switchgear and transformers.

Croydon.—ELECTRIC-DISCHARGE LIGHTING.—The Electricity Committee is to light bus routes at Woodside Green, &c., with mercury vapour electric-discharge lamps at a cost of £1,746.

LOANS.—Sanction is being sought by the Electricity Committee to loans of £75,000 for mains and £25,000 for street lighting.

Douglas (I.O.M.). — NEW EQUIPMENT. — It was reported recently that a new cooling tower, boiler plant and switchgear, involving building extensions, would be required to meet the load on the Council's system in 1938.

Grantown.—ELECTRICITY SUPPLY.—An offer by the Grampian Electricity Co., for the introduction of electricity to the town has been accepted.

Guildford.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £1,965.

Hoylake.—LIGHTING.—The Hoylake and West Kirby Urban District Council has decided upon a scheme for lighting the whole of the six miles of main thoroughfare in the Hoylake area by electricity.

Kent and Sussex.—LOWER CHARGES.—The Weald Electricity Supply Co., Ltd., has reduced the lighting flat rate in its area from 7½d. to 7d. per kWh.

Lancashire. — DANGER FROM FLOODS. — Serious flooding occurred recently at the Accrington electricity works, the River Hyndburn overflowing its banks and entering the basement of the works. The fire brigade worked hard to cope with the flooding. At Burnley water at one time lapped the engine base of the turbine auxiliary pumps. The coal elevator had to be stopped, because it was bringing up large quantities of water as well as coal, and all the boiler hoppers had to be fed by hand.

Lichfield. — ALTERNATIVE TARIFF.—The City Council has adopted an alternative tariff for business premises, with a fixed charge of £16 per kW of recorded maximum demand of lighting installation only, payable quarterly, and a running charge of 1d. per kWh for lighting, heating, cooking and water heating. Users of electric vehicles are offered an off peak tariff for battery charging purposes at ¼d. per kWh in the city area and ¾d. in the rural area.

RURAL EXTENSIONS.—The Rural District Council has consented to the Corporation erecting overhead lines to farms at Elmhurst, and to the Trent Valley and High Peak Electricity Co., Ltd., erecting lines to supply almhouses at Longdon.

London.—LIGHTING AT DICK WHITTINGTON'S CHURCH.—A new lighting installation has been carried out in the Church of St. Michaels Royal, College Hill, London, E.C., which was founded by Richard Whittington, Lord Mayor of London, and within the precincts of which he was buried. The system of lighting existing in the church until recently consisted of multiple light pendants suspended from the ceiling over the central nave. In collaboration with the architect, Mr. Martin Travers, a concealed scheme of lighting has recently been designed and installed by Thorn & Hoddle, Ltd. The light sources are concealed in the window recesses, the fittings being mounted about 25ft. above floor level. The concealed equipment consists of concentrating reflector fittings with universal joints. The reflectors are of prismatic glass with metal covers specially designed. The lighting effect is uniform throughout the church, except for the altar and chancel, where the illumination has been increased adequately to illuminate the picture and the altar. The wiring throughout is in screwed-steel conduit, the entire system being hidden from the view of the congregation, although at the west end of the church some of the walls are 4ft. 6in. thick. The switching arrangements and control of the lights enable any desired value of illumination to be obtained, with auxiliary lights for the pulpit and confessional. The total wattage of the installation itself, including the altar lighting, is 2,775. There are additional lights in the lady chapel, vestries, &c. Except for the old Flemish chandelier, used only for candles as a purely decorative feature, the old fittings have been removed.

HACKNEY.—The Electricity Committee is seeking sanction to borrow £100,000 for mains extensions.

HAMMERSMITH.—SUPPLY TO FLATS.—To afford a supply to a block of fifty-five flats and six shops in Goldhawk Road, the Electricity Committee recommends the extension of the high voltage distribution to a new sub-station on the site, and the equipment of the sub-station with the necessary switchgear and transformer at a cost of £507. The architects for the scheme have agreed to provide a number of utility plug-points in the flats and to install rising mains to afford electric cooking, heating and lighting supplies to each flat, the Council making a contribution of £50 towards the additional cost involved.

POPLAR.—The Borough Council has obtained sanction to borrow £35,000 for mains and services, £24,134 for sub-stations and equipment, £26,000 for consumers' wiring installations, £12,000 for meters and £4,000 for meters (second-hand).

EXTENSIONS AT BATTERSEA.—The London Power Co. has applied for consent to the installation at Battersea power station of one 100,000 kW turbo-alternator set, together with a house service set of 5,000 kW and other ancillary plant, and the application is supported by the Central Electricity Board which states that the new plant will be required to be available for the autumn of 1940. The new set will increase the generating capacity of the station from 220,000 kW to 325,000 kW. No specific mention is made of additional boiler units, and inquiry is being made on this point. While the factory inspector has reported to the effect that the washing plant at the Battersea power station has operated in an entirely satisfactory manner, no mention is made of any further report from the Government Chemist, and it is considered that no further extension of the station should be allowed until the Government Chemist has published a report on current conditions. The London County Council has suggested to the local authorities concerned that, with the object of co-ordinating their views, a conference of the officers of the local authorities should be held to consider the London Power Company's application.

CHEAPER ELECTRICITY.—London Associated Electricity Under-

takings, Ltd., has announced new electricity tariffs to apply throughout the six constituent companies' areas. They are a new two-part tariff with a running charge of ¾d. per kWh, reduced charges for the hire of electrical apparatus, revised hire purchase terms with smaller payments over longer periods, and a large scale scheme of "free" and assisted wiring.

Middlesbrough.—BULK SUPPLY.—The Town Council has approved a report of a sub-committee regarding negotiations with the North-Eastern Electric Supply Co., Ltd., for a supplemental agreement on a bulk supply of electricity.

Middlesex.—ELECTRICAL VOTE RECORDING.—The Buildings Committee is to install a new piece of apparatus, designed by the Reliance Telephone Co., Ltd., for use in conjunction with the voting machine installed in the Council Chamber. This mechanism is an automatic chart-recorder and indicates the manner in which each member votes when a division is taken. The results of divisions are at present ascertained by a clerk marking by hand on a chart the results shown on the panel of lights in the Council Chamber.

Poland.—ELECTRICITY SUPPLY PROGRESS.—Interesting details regarding the progress of electricity supply in Poland have just been issued by the Société d'Entreprises Electriques en Pologne, which controls a number of electricity undertakings in that country. The report states that, following an increase of 7 per cent. in the output during 1935, there is every likelihood that the present year will show a further advance. The number of consumers connected increased during the twelve months ended with September last by 4,700, bringing the total up to 68,256, the load on the plants advancing during the same period from 47,108 to 51,739 kW, of which latter 13,526 kW is for lighting and 38,213 kW for power purposes. In order to meet the increasing demand a new 3,200 kW turbo-alternator has lately been installed at the power station at Bialystok and one of 5,000 kW at Czestochowa. A new affiliated concern, the Société d'Electrification de la Region Czestochowa Plotrkow, has recently been formed for the supply of power to Klobucko, Karryk and Debow, and work is now in hand on the establishment of mains in those areas. The Pologne Company now has under its control 745 miles of distribution mains, an increase of about 80 miles during 1935-36.

Redcar.—A BATTERY CHARGING TARIFF.—A special tariff of ¾d. per kWh for charging batteries during off peak period has been introduced.

METERS.—The Electricity Committee is seeking sanction to borrow £4,500 for meters.

Stoke-on-Trent.—HIGH-VOLTAGE SUPPLIES.—The electrical engineer has reported that, consequent upon the growth of the load on the high-voltage system and upon the arrangements being made with regard to incoming supplies, it will be necessary to arrange for the provision of 33,000-V mains in the near future.

STREET LIGHTING.—Electric-discharge lighting is to be provided by the Highways Committee in Uttoxeter Road and Hartshill Road.

COMMERCIAL COOKING TARIFF.—The following tariff has been fixed with respect to commercial cooking:—Up to 1,000 kWh per quarter, 1d. per kWh; from 1,001 to 2,000 kWh at 0.9d.; from 2,001 to 3,000 kWh at 0.8d.; from 3,001 to 4,000 kWh at 0.7d.; from 4,001 to 5,000 kWh at 0.6d.; and all over 5,000 kWh at 0.5d. per kWh.

Scotland.—COUNTY COUNCIL AND C.E.B.—Intimation has been received by the Kirkcudbrightshire County Council from the Central Electricity Board to the effect that the selected stations of the Galloway Water Power Company will be operating under the direction of the Board as from January 1st, 1937. In view of this, the Board, which so far not not instituted a tariff for this area, has fixed one for South Scotland. A special position, however, obtains in Kirkcudbrightshire by virtue of the provisions of Section 108 of the Galloway Water Power Act, 1929, under which the County Council has the option of purchasing its supplies from the Galloway Company, and the Central Electricity Board has asked whether the Council proposes to purchase electricity from the Board at the tariff declared or to avail itself of supplies from the Galloway Company. It is proposed to ascertain which of the charges is the more favourable.

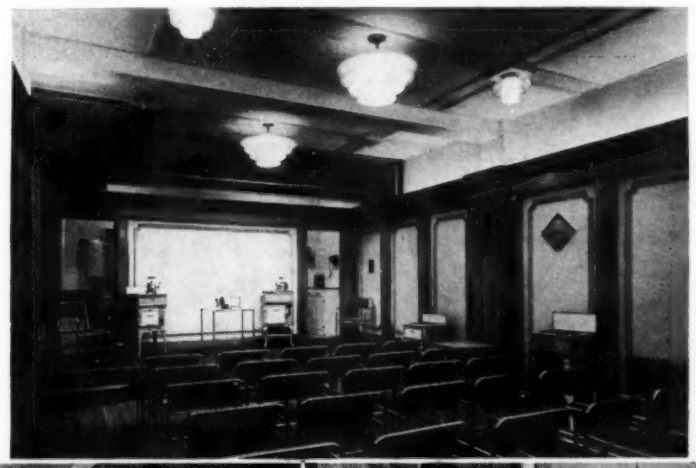
Swansea.—DISTRIBUTION.—Mains extensions and the erection of a new sub-station at Caerithen, at a cost of £3,265, have been recommended by the Electricity Committee.

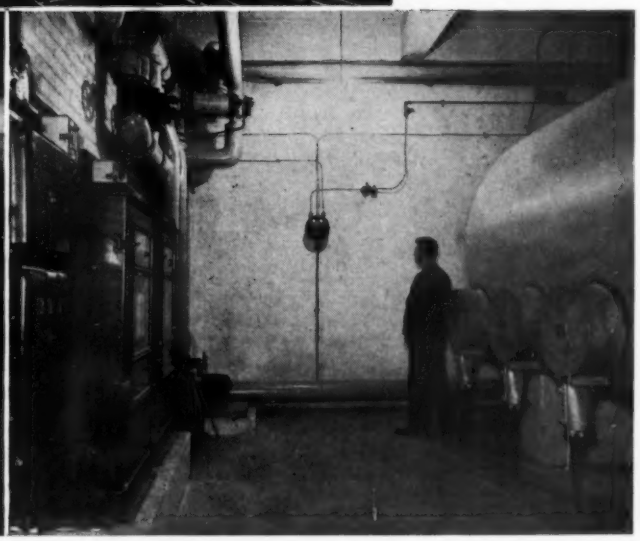
Tynemouth.—BULK SUPPLY AGREEMENT.—Subject to the approval of the Central Electricity Board the Town Council has decided to enter into a new agreement with the North-Eastern Electric Supply Co., Ltd., for the supply of electricity in bulk to the Corporation. The agreement will come into operation on January 1st and will last five years, with a mutual option to terminate it at the end of three years.

Wayland.—RURAL EXTENSIONS.—Consent has been given by the Rural District Council to the erection of overhead lines by the East Anglian Electricity Supply Co., at Old Buckenham and Garboldisham. The company has intimated its intention to carry out further extensions at Banham, East Harling, North and South Lopham, Eccles, Kenninghall, Quidenham, New Buckenham, Watton, Caston, Great and Little Ellingham, Griston, and Rockland.

Wimbledon.—VOLTAGE CHANGE.—Consent to the alteration of the declared pressure of the Corporation's supply from 220 V to 230 V is being sought by the Electricity Committee.

Wolverhampton.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains in the Scotlands area at an estimated cost of £2,955.





[*Elec. Rev.* photos.

The new showrooms of the Islington Electricity Department illustrating (top) the demonstration room (left) the main showroom, and (right) the water-heating chamber, showing the boiler fitted with Reyrolle elements and Brookhirst Switchgear contactors (see "Electrical Review" of November 6th, page 650)

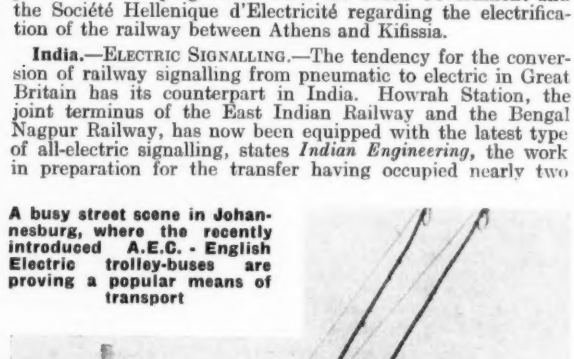
Traction

Bolton.—TRAMWAYS TO BE ABANDONED.—The Transport Committee has decided upon the gradual abandonment of the tramways as a means of passenger transport in the borough.

Darlington.—MORE TROLLEY-BUSES.—The Town Council is being recommended to purchase another eight trolley-buses.

Greece.—RAILWAY ELECTRIFICATION.—Negotiations are reported to be in progress between the Greek Government and the Société Hellenique d'Electricité regarding the electrification of the railway between Athens and Kifissia.

India.—ELECTRIC SIGNALLING.—The tendency for the conversion of railway signalling from pneumatic to electric in Great Britain has its counterpart in India. Howrah Station, the joint terminus of the East Indian Railway and the Bengal Nagpur Railway, has now been equipped with the latest type of all-electric signalling, states *Indian Engineering*, the work in preparation for the transfer having occupied nearly two years. A two-storey building erected near the station takes the place of two cabins. In it, coloured lights on a specially constructed diagram board above the interlocking machinery show the progress of all trains approaching or leaving the station. The ground floor is divided into four rooms containing the power equipment and controlling apparatus. There are three sources of power supply, making the possibility of a prolonged breakdown extremely remote.



A busy street scene in Johannesburg, where the recently introduced A.E.C. - English Electric trolley-buses are proving a popular means of transport

Communications

Belgium.—TELEPHONE PROGRESS.—The Régie des Télégraphes et des Téléphones Belges has lately issued its report, showing the development of telephonic communication in Belgium during the year ended with February, 1936. The accompanying table gives the number of subscribers to the system and that of the instruments in use at the end of February in each of the past five years.

	No. of subscribers.	No. of instruments.
1936	248,000	335,000
1935	237,600	319,000
1934	234,100	313,000
1933	226,900	298,000
1932	227,300	296,000

The present number of subscribers is equal to 4 per cent. of the inhabitants of the country. Many of the exchanges have already been converted to automatic operation, while others are in process of conversion. Recent activities include the provision of automatic or semi-automatic exchanges in rural areas, and a "talking clock" in Brussels which is announcing the exact time to over 75,000 subscribers each week. Connections are also being made with the Antwerp, Liège, Ghent and Charleroi exchanges so that subscribers in those towns may receive the time from Brussels, where a standby talking clock is being installed.

Isle of Man.—RADIO BEACON.—A radio beacon with a thirty-mile range is to be installed on the Victoria landing pier, Douglas.

Japan.—RADIO-TELEGRAPH COMMUNICATION WITH RUSSIA.—Direct radio-telegraph communication has recently been established between Tokyo and Moscow.

South Africa.—NEW TRUNK EXCHANGE.—A new trunk telephone exchange has just been brought into service by the South African Post Office at Johannesburg. The equipment, which marks a further advance in the art of telephony, has been designed by the Automatic Telephone & Electric Co., Ltd., in collaboration with engineers of the South African Post Office, and was manufactured in the company's works at Liverpool. The exchange operates on the "on demand" principle and enables calls over the Union's trunk network and international circuits to be handled with a speed hitherto unattainable by straightforward manual operation. Operators are still employed to establish connections, but their duties are facilitated and accelerated by automatic switching devices entirely new to trunk exchange working. The mechanism employed was developed by the company's engineers for the British Post Office, and has been adopted as standard for automatic telephone exchanges in Great Britain. Among the many important functions performed automatically are the selection and placing in circuit of "repeaters" to provide "balancing networks" and speech amplification to suit individual calls, and the more rapid and even distribution of calls among the operators on duty affords subscribers the quickest possible service.

A girl employé at the Ferranti valve factory holding one of the latest 14-in. cathode-ray tubes that are now being manufactured by the company for use in its television receivers when released

Sir Philip Dawson on Railway Electrification

THE principal guest at the luncheon of the Batti-Wallahs' Society on December 17th was Sir Philip Dawson, who gave an interesting address on railway electrification. In introducing him, Lt.-Col. W. A. Vignoles, president, also welcomed Mr. W. J. Davey, of arc lamp fame, and Mr. Boyd Cable, the well-known author of sea stories.

Sir Philip said his connection with electricity for traction purposes extended over forty years, and he was one of the pioneers of electric tramways. He referred to the early days of electric traction, and stated some of the difficulties experienced when the first commercial tramway was inaugurated at Bristol, and later with the electrification of the Liverpool tramway. With regard to railway electrification, the portion of the L.B. and S.C. Railway between London Bridge and Victoria was first electrified, and at that time all the other railways were against electrification. Present-day results, however, showed that it had proved a colossal success. After the war the line from London to Brighton was electrified, and with the grouping of the railways the Southern Railway wisely decided to extend this form of traction. The electrification now completed, however, was what had been recommended fifteen years before. The recent statement made by Mr. Cox, who was traffic manager of the Southern Railway, indicated the success of electrification, and as an instance, the service to Hastings had been doubled in one year. Electric traction was the only sure way of relieving traffic congestion in areas around big cities, and the Weir Report and that of the Royal Commission on Transport both supported this contention. He suggested that all suburban lines on the L.N.E.R. within thirty miles of Liverpool Street should be electrified. Investigations carried out showed that the electrification of these lines would prove advantageous to the company. Sir Philip suggested that other railways should be guided by the success which had attended the electrification of the Southern Railway. He referred to Diesel-electric traction, and said that not sufficient advantage was being taken of its possibilities in this country. He instanced a number of American railways on which this system had been adopted, and showed that Diesel-electric trains on these lines attained speeds averaging from 65 to 100 miles per hour. A vote of thanks to Sir Philip was proposed by Mr. F. Pooley.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Abertillery.—December 31st. U.D.C. Meters and lamps. (December 11th.)

Australia.—BRISBANE.—January 20th. City Electric Light Co. 11,000-V and 415-V indoor type switchgear. (T.Y. 30988.)*

Birmingham.—January 13th. Salvage and Stables Committee. Twenty-two lead-plate batteries for electric vehicles. (See this issue.)

Bristol.—January 11th. Corporation. H.v. switchgear and l.v. sub-station switchgear. (December 18th.)

Buckhaven and Methil.—January 6th. Town Council. Electric lighting at 104 houses. E. L. Forsyth, architect and surveyor, Methil Brae, Methil.

Cheltenham.—January 7th. Corporation. Electrical installations in 190 houses on the St. Paul's estate and 178 houses on the St. Peter's estate. (See this issue.)

Chipping Norton.—January 6th. R.D.C. Duplicate sets of centrifugal pumps and electric motors, with automatic control. W. H. Bateman, consulting engineer, Batheaston, Bath.

Eastbourne.—January 14th. Electricity Committee. Stores for twelve months; wiring installations; and reconditioning of cookers, water heaters and wash boilers. (December 11th.)

East Ham.—January 4th. Corporation. Mercury discharge lamps, lanterns, brackets, poles, &c., for lighting of certain main roads. (December 18th.)

Egypt.—CAIRO.—February 2nd. Ministry of Public Health. H.v. transmission line to the Fayoum drainage sewage purification works. (T.Y. 30977.)*

Erith.—January 4th. U.D.C. Electricity Department. Cable. (December 18th.)

Esher.—December 29th. U.D.C. Extension of the Gamewell fire alarm system. Chief officer, Fire Brigade, Central Fire Station.

Fife.—December 28th. County Council. Electric lighting at twenty houses at Leuchars. J. Gentles & Son, Central Chambers, Kirkcaldy (deposit £1 1s.).

Great Yarmouth.—January 2nd. Borough Council. Cable. (December 11th.)

Hendon.—December 29th. Corporation. Electrical installations in branch public library, open air swimming pool, maternity and child welfare centre, and school. (December 11th.)

Heston and Isleworth.—January 4th. Electricity Department. Switchgear and modifications to 11-kV switchboard. (December 18th.)

Hoylake.—January 7th. U.D.C. 250 weldless steel street lighting standards, brackets and fittings. (See this issue.)

India.—NEW DELHI.—January 12th. Stores Department. Motor generating sets. (T.Y. 30982.)*
January 21st. Steel conduit and fittings for electric wiring. (T. 31023.)*

Kidwelly.—January 1st. Borough Council. One electrically driven centrifugal pump (2,500 gal. per hr.). Borough surveyor, Borough Offices.

Kirriemuir.—December 31st. Town Council. Electric lighting at thirty-five houses. Lowe & Barrie, Bank of Scotland Buildings, Bank Street (deposit £1 1s.).

Lanarkshire.—December 28th. County Council. Electrical and heating installations at the new R.C. school, Lanark. J. Stewart, County architect, 32-36, Albert Street, Motherwell.

Lincoln.—January 8th. Electricity Department. Switchgear and transformers. (December 18th.)

London.—January 1st. West of India Portuguese Guaranteed Railway Co. Five 3-ton electric level luffing wharf cranes. L. G. Bouchier, secretary, 4, Coleman Street, E.C.2 (deposit £1, not returnable).
January 4th. South Indian Railway Co. Copper rods, sheets and tubes, brass rods and wire. Company's offices, 91, Petty France, S.W.1 (deposit 10s., not returnable).
HAMMERSMITH.—January 14th. Electricity Department. Switchgear, transformer kiosk and transformers. (December 18th.)

Manchester.—January 11th. Electricity Committee. Two mercury-arc rectifier equipments. (See this issue.)
January 12th. Transport Committee. Overhead equipment materials for trolley-bus operation and cadmium copper trolley wire (grooved). General Manager, Transport Department, 55, Piccadilly.

Middlesex.—January 18th. County Council. Electrical installations at the new Technical Institute, Twickenham. (December 11th.)
January 25th. Engineering works, comprising electric lighting, power, bells, telephones and clocks, at the new Children's Home, Dobbs Corner, East Bedfont. (December 18th.)

Midlothian.—December 30th. County Council. Electrical work at 124 houses at Loganlea, Addiewell, and Pumpherston housing estates. County architect, 10, Drumsheugh Gardens, Edinburgh, 3.

Newbiggin-by-the-Sea.—January 7th. U.D.C. Electric lighting installations in 106 houses at Woodhorn Demesne. (See this issue.)

New Zealand.—WELLINGTON.—January 11th. Posts and Telegraph Department. Telephone cable. (T. 30975.)*
January 12th. Cadmium copper wire. (T. 30973.)* Insulators. (T. 30974.)*
January 13th. Galvanised wire. (T. 30971.)*
January 20th. Insulated copper wire. (T.Y. 30972.)*
February 10th. Dry cells. (T. 30997.)*
February 2nd. Public Works Department. Transformers. (T.Y. 30993.)*

Northern Ireland.—BELFAST.—January 21st. Electricity Committee. Electrical stores for twelve months. (See this issue.)

Queensbury.—December 31st. U.D.C. Electrically driven booster pumping installation for water supply to 154 houses. J. N. Wood, consulting engineer, Waterworks Engineer's Office, Devonshire Street, Keighley.

Salisbury.—January 15th. Town Council. Rewiring the fire brigade call bell system. Chief Officer, Fire Brigade, Salt Lane Fire Station.

Sheffield.—January 11th. Electricity Committee. Transformers. (December 18th.) Transformer and on-load tap-changing gear. (See this issue.)

Solihull.—December 28th. U.D.C. Electrically driven, vertical spindle, centrifugal pumps, with motors, switchgear, electric wiring, &c., for the Purnell's Brook sewerage, Knowle. R. Dunn, engineer and surveyor, Council Offices, Streetsbrook Road.

South Africa.—CAPE TOWN.—January 20th. Electricity Department. Cable. (T.Y. 2232.)*
PRETORIA.—January 29th. Union Tender and Supplies Board. Telegraph and telephone line material. (T.Y. 31015.)*

Southport.—January 18th. Southport and District Water Board. Two electrically driven centrifugal deep-well pumps. Engineer and manager, 14, Portland Street (deposit £3).

Stoke-on-Trent.—January 13th. Electrical Engineer's Department. High-pressure mercury vapour lamps for lighting in Victoria Road, &c., Fenton. (See this issue.)

Sutherland.—January 9th. County Council. Electric lighting in twenty-two houses at Golspie, Bonarbridge and Embo. E. W. Brannon, architect to the local authority, Dornoch.

Swansea.—January 4th. Electricity Department. Meter test-room equipment. (See this issue.)

Swindon.—December 31st. Great Western Railway Co. Various stores, including electrical conduit, fittings, &c., for a period from February 1st. Stores superintendent.

Uruguay.—MONTEVIDEO.—January 29th. State Electricity Supply and Telephones Administration. 100 single-pole automatic circuit-breakers. (T.Y. 30984.)*
February 18th. Six electric generating sets, with accessories and spares. (T.Y. 31004.)*

Weobley (HEREFORD).—January 11th. R.D.C. Plant, including a high-speed, high-lift, centrifugal pump (2,000 gal. per hr.), with electric motor and automatic operating gear, for the Weobley water supply. W. H. Grout, clerk to the Council (deposit £2 2s.).

West Riding.—January 25th. Public Assistance Committee. Electric wiring in connection with heating and hot-water installations at the County Poor Law Institution, Batley. P. O. Platts, architect, County Hall, Wakefield (deposit £5).

Worthing.—January 6th. Borough Council. Street-lighting equipment, including concrete lamp columns and time switches. (December 18th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—Housing Committee. Accepted. Electrical work at the Tanfield housing estate (£570).—R. A. Mair.

Chester.—Assistance Committee. Recommended. X-ray installation at Institution (£1,270).—Alexander & Fowler.
Electricity Committee. Recommended. Underground cables for three years.—Callender's Cable & Construction Co.

Dartford.—Electricity Committee. Accepted. Transformer (£165).—Crompton, Parkinson, Ltd. Cooker wiring for twelve months.—W. J. Bayliss. Wiring under assisted scheme for twelve months.—Dartford Electrical Co.

Kirkcaldy.—Accepted. Electric lighting and other equipment at the new fire station (£505).—Oliver Melville & Co.

Lochgelly (FIFE).—Town Council. Accepted. Electrical work at fifty-two houses (£371).—A. & C. Edelman, Ltd.

London.—POPLAR.—A Correction.—In the ELECTRICAL REVIEW for December 4th (page 799) we reported that the tender of Messrs. Donald Smith & Co. for the installation of heating and ventilating services at the Town Hall had been withdrawn. This statement was inaccurate, and we now learn officially that Messrs. Donald Smith's tender at £19,811 has been accepted by the Council.
ISLINGTON.—Cleansing Committee. Recommended. Electric baling press (£195).—Heenan & Froude, Ltd.
WESTMINSTER.—Highways Committee. Recommended. Eight mercury arc rectifiers (£126 each).—Nevelin Electric Co. Eighteen electric mechanical horse units (£500 each).—Electricars, Ltd. Eighteen batteries (£198 each).—Young Accumulator Co.
BERMONDSEY.—Electricity Committee. Accepted. Five-panel h.p. switchboard for Bevington Street (£789), extension to 6,600-V switchboard at the Neckinger sub-station (£318), and seven-panel l.p. switchboard (£310).—A. Reyrolle & Co.
STEPNEY.—Electricity Supply Committee. Recommended. Supplies for twelve months from January 1st: 5-A single- and

two-way switches (£294).—C. H. Parsons, Ltd. Cooker control units (£662), 180,500 yd. of t.r.s. cable of various sizes (£1,669), and 37,000 yd. of v.i.r. cable (£421).—Wholesale Fittings Co. Replacement of the conveyor chain forming part of ash discharge plant in No. 2 boiler house at the Limehouse generating station (£294).—W. J. Jenkins & Co.

Accepted. Re-tubing of a feed heater of No. 8 turbo-alternator at the Limehouse station (£270).—Yorkshire Copper Works, Ltd.

L.C.C.—Sound-on-film equipment at Long Grove and West Park Mental Hospitals and the Manor, Epsom:

	Basis 1.	Basis 2
	£	£
British Thomson-Houston Co.	*1,270	—
Film Industries, Ltd.	1,269	1,329
Kalee Ltd.	1,315	1,511
	1,764	1,926
G. B. Equipments, Ltd.	1,690	—
Western Electric Co.	2,625	2,678

* Includes provision of arc lamp resistances.

Automatic cold storage plant in the Mortuary, Mile End Hospital:

	£		£
International Refrigerator Co. Accepted	790	Frigidaire, Ltd.	910
Pulsometer Engineering Co. ...	820	Lightfoot Refrigerator Co. ...	945
Asco Refrigeration, Ltd. ...	861	Coldair, Ltd.	974
E. West and Beynon, Ltd. ...	878	L. Sterne and Co.	991
Leda Electric, Ltd.	890	U.D. Engineering Co.... ...	1,005
British Automatic Refrigerators, Ltd.	910	H. J. West and Co.	1,012
		J. and E. Hall, Ltd.	1,171

Wiring and fittings for electric lighting, heating and power at the Fulham W. Central (Boys') school:

	£		£
Archibald Meckhonik. Accepted	1,038	City Electrical Co.	1,125
Read and Partners, Ltd. ...	1,060	T. Clarke and Co.	1,154
Twentyman and Wilmot ...	1,085	A. Higginbotham and Sons ...	1,170
A. Hawkins and Sons ...	1,098	Henfrey Electrical Installations	1,214
Buchanan and Curwen, Ltd....	1,110	Springvale Electrical Co. ...	1,285

Middlesbrough.—Town Council. Accepted. Fourteen 250-kVA transformers.—Electric Construction Co.

Northern Ireland.—BELFAST.—Estates Committee. Accepted. Electric lighting in 124 houses on the Whitehall estate (£616).—D. Gamble & Co.

Shipley.—Highways Committee. Accepted. Standards and lanterns for the lighting of Otley Road (£555).—G.E.C.

Stockton-on-Tees.—Town Council. Accepted. Switchgear.—Harland Engineering Co. (£618); Crompton Parkinson, Ltd. (£760). Two 750-kVA transformers (£725).—Ferranti, Ltd. Five kiosks (£1,385).—Crompton Parkinson, Ltd. One 200-kVA transformer (£167).—G.E.C.

Tynemouth.—Town Council. Accepted. Cables (£301).—B.I. Cables, Ltd.

Wolverhampton.—Electricity Committee. Accepted. Fire protective apparatus for the Commercial Road switchhouse (£1,606).—Mather & Platt, Ltd.

Notes

Action Against Directors Fails

In the Chancery Division on December 16th Mr. Justice Farwell had before him an action brought by Mr. Herbert Hepworth Thompson on behalf of himself and all other shareholders in Holophane, Ltd., except the personal defendants and their nominees against Mr. Otis Angeol Mygatt, Lord Ernest Hamilton, Baron Fairfax of Cameron, Mr. William Thomas Dean and Holophane, Ltd. Mr. F. R. Evershed, K.C., for the plaintiff, stated that he asked for a declaration that the passing of a resolution by the directors of the defendant company on December 23rd, 1935, whereby it was resolved to pay £100 per month to Mr. O. A. Mygatt as chairman of a joint committee was against the interest of the company and that in the circumstances the resolution should be set aside. Mr. Thompson further asked, as against the defendant Mr. Mygatt, for an order that he should account for the sums received by him in pursuance of the resolution and to repayment of them by him.

Mr. Evershed said that the basis of the action was that the defendant directors, in passing the resolution, were not considering the matter from the point of view of the interests of the company, but were considering how they could benefit Mr. Mygatt who had been connected with the company for several years and was about 75 years of age. Mr. Mygatt, said counsel, had not done any work for the company for about twenty years, and he was drawing £200 a year as director's remuneration for which he was rendering no service at all.

In November, 1935, a recommendation was made that a joint committee should be formed of members of the board, including Mr. Mygatt, and the representatives of an allied French company with a view to co-ordinating development, and the directors decided that if Mr. Mygatt would formulate a scheme they would consider it. On December 23rd, 1935, Mr. Mygatt sent the board a letter in which he formulated his scheme and which contained the proviso that he should be chairman of the joint committee and receive £100 per month to cover his expenses and as remuneration. That proposal was accepted.

At the conclusion of the arguments his Lordship, in delivering judgment dismissing the action, said the Court could not go into the question whether the appointment of the joint committee or the work it was going to do was for the benefit of the company as a whole or not. That was a matter for the directors to consider for themselves. Unless the plaintiff charged fraud against the directors he could not get anywhere. There was no suggestion, however, that the defendants were not acting honestly. The action was hopeless and would be dismissed with costs.

Borough Polytechnic Exhibition

The high standard of work carried out by students at the Borough Polytechnic was revealed at the annual exhibition held on Friday and Saturday last. The school was opened for visitors to make a tour of the workrooms, see the students at work, and view the results of the various stages of their training. From the electrical point of view models had been prepared showing insulation and methods of connection for overhead telephone lines, methods of wiring and connecting switches and cable jointing. Students were operating various electrical machines and giving demonstrations on the high-voltage plant, while work was exhibited which had been prepared in various shops, including the plastic materials laboratory, the electric welding shop and in the elementary and advanced electrical laboratories. The work of the junior day technical school for boys was also shown.

Adjacent Gas and Electricity Services

Five people were killed recently when two houses in Newcastle-on-Tyne collapsed as the result of an explosion due to the ignition of gas by an electric arc. At an inquest held in Newcastle on December 16th it was stated that the electric cable involved was in contact with a gas pipe and arcing had burned a hole in the pipe. Representatives of the local gas and electricity companies stated that care was always taken not to allow the services to be laid too near one another. In this case there had been negligence on the part of whoever was responsible for installing the later service. The jury declined to decide that there had been negligence, but in returning a verdict of "Accidental death" expressed the view that gas pipes and electric cables should always be laid at such a distance from one another as to preclude damage or defect in one of them affecting the other.

Fatality

An inquest was held at Keswick on December 16th into the death of Jonathan Longbotham, of Windebrowe, near Keswick. It was stated in evidence that Longbotham was found in contact with a 2,000-V line which appeared to have been broken by a gale or a falling branch. His hands and body were seared, and the clothes which he was wearing were burned through to his left arm. A police constable said that he did not think any of the branches which had been blown down was heavy enough to break the wire, which had broken close to a bracket on the roof of Longbotham's cottage. A solicitor who appeared for the local electricity supply company said that the manager and engineer were willing to tell the Coroner anything he wished to know; they had nothing to hide. It was clear that the wind or a falling branch had broken the wire. The Coroner accepted this view in returning a verdict of "Accidental death due to electric shock."

Non-vibrating Transmission Lines

In a recent issue of *L'Energia Elettrica* Signori Preiswerk and Dasseto describe a method they have devised of overcoming vibration in overhead transmission lines. Broadly, it consists of using a cable the two components of which are subject to different frequencies of vibration, one neutralising the other. The cable is composed of a hollow outer portion and a core, a certain degree of "play" being provided between the two. Details are given of the method of calculating the tensions of cables, the conditions to be observed in erecting them and the anchoring and connecting sleeves which must be used. Comparative tables are also given of the relation of the chief characteristics of different forms of cables—Aldrey alloy, Aldrey-steel, aluminium, aluminium-steel, copper, &c.

Appointments Vacant

Chief clerk and lady cookery demonstrator for Birkenhead Electricity Department.

Meter fixer for Worksop Electricity Department.

Cooking demonstrator and lecturer, assistant demonstrator and showroom assistant, showroom assistant and sales assistants (all females) for Islington Borough Council.

Four assistant engineers in the Department of Posts and Telegraphs, I.F.S.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

HYFLO electric fires.

The address is required of Beddington, Lidiatt & Co. (Savage health motor).

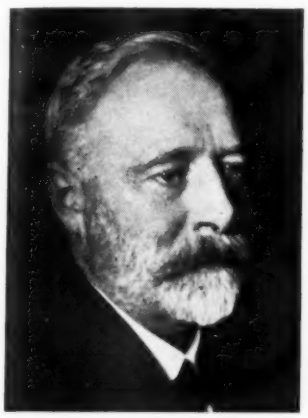
Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Sir Bernard E. Greenwell, Bt., and **Mr. A. W. Bolden** have joined the board of Davy, Paxman & Co. (Colchester), Ltd., to fill the vacancies caused by the resignation of Messrs. F. Jarrett and J. W. Dean.

Mr. A. P. McDouall, chief engineer to the Notting Hill Electric Lighting Co., Ltd., is retiring on the completion of forty years' service with the company. Mr. McDouall obtained his A.C.G.I. (Central Institution) in 1892, and after about four years at Hull and Bradford became assistant engineer to the Notting Hill Co.



[*Elliott & Fry.*
Mr. A. P. McDouall

Mr. J. Rees, who has been associated with the North-Eastern Electric Supply Co. for thirty-three years, has received a presentation, on behalf of his colleagues, to mark his retirement. Mr. Rees has been superintendent of the Transport Department since 1906, and started work with the company as an assistant at the Carville power station, Wallsend. He has seen the company's fleet of vehicles grow from eight, covering an area of 540 sq. miles, to 239, covering an area of 5,600 sq. miles. The presentation was made by Mr. P. C. Parker, resident engineer.

Mr. L. C. Gamage, director and secretary of the General Electric Co., Ltd., has been elected treasurer of the Chartered Institute of Secretaries.

We are informed that at the annual dinner of the Association of Consulting Engineers, held recently, the chairman, Mr. W. T. Halcrow, acting on behalf of the members, presented **Mr. A. H. Dykes** with his portrait in oils painted by Mr. Howard Somerville, R.P., in appreciation of his services for twenty-five years as honorary secretary of the Association.

Mr. R. J. Harvey, M.I.E.E., has been appointed to act as joint honorary secretary, in conjunction with Mr. S. R. Raffety.

We tender our congratulations to **Sir J. J. Thomson,** F.R.S., who celebrated his eightieth birthday on Friday last.

[*Elliott & Fry.*
Commander Rollo Appleyard

Commander Rollo Appleyard, who has written the article on "The Master of Trinity" (reviewing Sir J. J. Thomson's volume of "Recollections and Reflections"), appearing on page 890 of this issue, is known to many readers of the ELECTRICAL REVIEW, as well as to many non-electrical literary men and physicists. He is one of the few still amongst us who belonged to the much-esteemed group of submarine-cable men who spent a large part of their career at Silvertown or on Silvertown affairs. Of his activities at the Admiralty at Whitehall during the War he allows a little evidence to steal into his article when he refers, with certainty born of intimate knowledge, to work done in connection with submarine detection. Many are the interesting achievements of Commander Appleyard in biographical and technical literature, including his contributions to *The Times* on the status of engineers in the Royal Navy, and his excellent "Tribute to Michael Faraday," published at the time of the Faraday Centenary celebrations in 1931. "Sir J. J.," of whom he writes, is only ten years his senior, yet Appleyard carries himself with a charming gaiety of spirit, taking pride in the fact, as we do, too, that it is just fifty years since he contributed his first article to the ELECTRICAL REVIEW. We have refrained from calling him our oldest contributor, because there are others who could and might lay claim to that position.

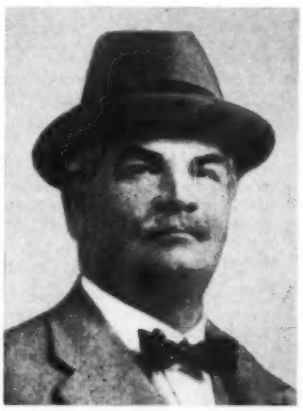
Mr. J. J. Middleton has been elected a member of the London and Home Counties Joint Electricity Authority as the representative of the Urban District Councils of Chorleywood, Harrow, Rickmansworth, Ruislip-Northwood and Uxbridge and the Rural District Council of Watford.

Mr. W. F. Higgs, governing director of Higgs Motors, Ltd., is sailing on the *Windsor Castle* on January 8th for South Africa, and expects to arrive in Johannesburg on January 27th. During his stay in South Africa his address will be c/o the Griffin Engineering Co., Ltd., 43, Anderson Street, Johannesburg.

Obituary

Mr. A. C. Jolley.—By the death on December 4th, at the age of sixty years, of Alfred Charles Jolley the profession has lost a teacher whose expert knowledge of electrical instruments was widely recognised. He commenced his teaching career at the Birkbeck Institute, and prior to 1897 he was associated with the design and manufacture of Everett electro-physical equipment. In that year he joined the staff of the Northampton Institute, Clerkenwell, and rose to a senior demonstratorship. In 1905 he was elected an associate member of the I.E.E. He became chief assistant (electrical section) at the College in 1921, and four years later was appointed head of his department, which post he occupied until his formal retirement a few months ago. Mr. Jolley's annual reviews of progress in instrument design contributed to the ELECTRICAL REVIEW were widely read.

Mr. Morton Beales.—We regret to learn that Mr. Morton Beales, M.I.E.E., of Messrs. Gillespie & Beales, Amberley House, Norfolk Street, W.C.2, died suddenly at Bristol on December 10th. Mr. Beales, who was well known to members of the electrical trade, served his apprenticeship with Messrs. Ferranti, and later joined Messrs. J. G. White & Co., Ltd. His next engagement was with the British Westinghouse Co., which he left to become manager of Messrs. Bruce Peebles & Co., Ltd. For the last 25 years, however, he had been a partner in the firm of Gillespie & Beales mentioned above.



The late Mr. M. Beales

Mr. F. R. Welles.—We regret to record the death on December 14th, at the age of eighty-two, of Mr. Francis Raymond Welles, who commenced his electrical career as assistant to the president of the Western Electric Manufacturing Co. in Chicago. As the manufacturing associate of "The Western Union" his company entered the telephone field on the Edison side, and had made such outstanding progress in that field that when the patent situation was determined in favour of Bell and the amalgamation of other licensees was agreed upon the absorption was effected by the Western Electric Co. In 1880 Mr. Welles went to Australia, founded the Melbourne Telephone Exchange Co., and opened up business relations with the Governments of New South Wales and New Zealand, which led to the establishment of telephone exchanges in those and neighbouring territories. Later he came to Europe to take charge of the allied undertaking—the Bell Telephone Manufacturing Co., at Antwerp. Thenceforward until his retirement he was the European and overseas representative of the Western Electric Co. He thus laid the foundations and added stone by stone to the structure of a world-wide and rapidly developing business later acquired by the International Standard Electric Corporation. In 1911 Mr. Welles retired and usually spent the summers in France and the winters in California, maintaining at all times correspondence with his old telephone friends throughout Europe and abroad.

There are many, even amongst our telephonic readers of today, who may wonder that the name of a pioneer who has done so much should be comparatively so little known. The explanation is that Mr. Welles was absorbed in the accomplishment of effective works on behalf of his company and strenuously resisted any identification of such work with himself.

Mr. P. Sheridan.—The death is reported at the age of sixty of Mr. Phillip Sheridan, one of the founders and managing director of the Strand Electric & Engineering Co., and a director of Strand & Interchangeable Signs, and Strand Electric Holdings.

Will.—Sir John Hunter, K.B.E., chairman of Sir William Arrol & Co., Ltd., left personal estate in Great Britain valued at £196,128.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Neon Products (Northampton), Ltd.—Private company. Registered December 18th. Capital, £3,000. Objects: To acquire the business of Neon Products Co. carried on by F. B. Spencer, R. Spencer, T. Cox, H. W. F. Stewart and R. H. Sly at Kingsthorpe Hollow, Northampton, and to carry on the business of electrical engineers and contractors, electric lighting and advertising specialists, neon sign manufacturers, radio engineers, &c. The directors are: F. B. Spencer, 17, Queen's Park Parade, Northampton; F. W. Clark, The Malting House, Boughton, Northants; and T. Cox, 45, Artizan Road, Northampton. Secretary: F. W. Clark. Registered office: Kingsthorpe Hollow, Northampton.

Grylls Radio, Ltd.—Private company. Registered December 14th. Capital, £1,000. Objects: To acquire the business of a radio dealer carried on by T. H. Grylls at Electra House, Clarence Road, Grays, and 31a, Dock Road, Tilbury, and to carry on the business of manufacturers of and dealers in radio, wireless and television instruments, &c. The subscribers are: T. H. Grylls and Mrs. Winifred M. Grylls, both of 68, Southend Road, Grays, Essex. T. H. Grylls is to be permanent governing director. Secretary: Marjorie B. Jeffs. Registered office: Electra House, Clarence Road, Grays, Essex.

Radio (West Hartlepool), Ltd.—Private company. Registered December 17th. Capital, £1,500. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets, &c. The directors are: H. Middleton, "Glenariff," Elm Grove, West Hartlepool, and R. H. Lewis, 6, Allendale Street, Seaton Carew, West Hartlepool. Registered office: 49, Whitby Street, West Hartlepool.

Turb-o-Foam, Ltd.—Private company. Registered in Edinburgh December 17th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical appliances for the generation of foam or for any other like purpose, &c. The directors are: G. W. Haycock, 52, Stewart Drive, Clarkston, Renfrewshire, and two others. Registered office: 53, Bothwell Street, Glasgow.

Carrier-Call (Great Britain), Ltd.—Private company. Registered December 16th. Capital, £100. Objects: To carry on the business of electrical engineers and manufacturers, more particularly of radio and telephone apparatus, &c. The subscribers are: E. W. Dinnick and S. Goodwin, both of King William Street House, E.C.4. Secretary: J. J. B. Cross.

Mid-Electric, Ltd.—Private company. Registered December 16th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in plant, apparatus and equipment for the use of electricity, gas and oil and all kinds of hydraulic, mechanical, electrical and chemical instruments, &c. The permanent directors are: R. R. Surridge, Royal Air Force Club, 128, Piccadilly, W.; and A. W. W. Tulip, 26, Annesley Grove, Nottingham. Registered office: 66, Mansfield Road, Nottingham.

Tubelight Holders, Ltd.—Private company. Registered December 14th. Capital, £1,000. Objects: To acquire the right to manufacture and sell tubelight holders under patent No. 6,716 of 1936, and to carry on the business of electricians, mechanical engineers, workers or dealers in electricity for motive power or light, &c. The directors are: J. A. C. Sumner, 111, Dukes Avenue, New Malden, Surrey; and A. J. Clayton, 13, Christchurch Road, S.W.2. Registered office: Poultry Chambers, 11, Poultry, E.C.2.

John Boult & Co., Ltd.—Private company. Registered December 10th. Capital, £700. Objects: To acquire the engineering business now carried on by Geo. W. Boult, trading as J. Boult & Co. at 120, Duke Street, Liverpool, and to carry on the business of manufacturers of and dealers in dynamos, motors, armatures, magnetos, &c. The directors are: G. W. Boult, 14, Marmion Road, Sefton Park, Liverpool; and S. F. Claydon, 22, Alvanley Road, West Derby, Liverpool. Registered office: 120, Duke Street, Liverpool.

County Radio, Ltd.—Private company. Registered December 14th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in wireless aerials and apparatus, wireless sets, cabinets, dials, &c. The directors are: K. L. Humphreys, 11, Pine Ridge, Carshalton, Surrey; and M. C. Elliott, Tregurrian, 37, Sussex Road, Carshalton Beeches, Surrey.

Returns of Electrical Companies

Weston Electrical Instrument Co., Ltd.—The nominal capital has been increased by the addition of £30,000 in £1 ordinary shares beyond the registered capital of £10,000. The 2,000 shares of £5 in the original capital have been subdivided into 10,000 shares of £1 each. At July 30th, 1936, the Weston Electrical Instrument Corporation of Newark, New Jersey, U.S.A., held 1,998 £5 shares out of 2,000 issued.

Associated Distributors, Ltd.—Satisfaction to the extent of £10,448 (being whole amount) on November 16th, 1936, of debenture dated June 7th, 1926, and registered June 9th, 1926.

L. Adams, Ltd.—Satisfaction on December 7th, 1936, of debenture dated June 29th, 1933, and registered July 7th, 1933. (According to the register of mortages, the debenture registered July 7th, 1933, originally secured £1,000).

British Central Electrical Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 4th, 1936, to secure £1,000 and ranking pari passu with an existing debenture for £1,000. Holders: Branch Nominees, Ltd.

A. J. Shrosbery & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 24th, 1936, to secure £300. Holder: W. F. Hawkins, 66, Southend Road, Grays.

Nelson Engineering Co., Ltd.—Issue on December 5th, 1936, of £50 debentures, part of a series already registered.

Birmingham Electric Furnaces, Ltd.—Capital, £1,000 in £1 shares. Return dated July 8th, 1936. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Drury Radio Co., Ltd.—Capital, £2,000 in £1 shares. Return dated June 22nd, 1936. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Morland Electric Welding Co., Ltd.—Capital, £4,000 in £1 shares. Return dated October 6th, 1936. 2,302 shares taken up. £2,302 paid. Mortgages and charges, nil.

Vincent Switchgear Manufacturing Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 12th, 1936. 7,948 shares taken up. £7,948 considered as paid. Mortgages and charges, £3,000.

Weald Electricity Supply Co., Ltd.—Capital, £1,000,000 in £1 shares. Return dated March 31st, 1936 (filed October 30th, 1936). 350,000 shares taken up. £346,000 paid. £4,000 considered as paid. Mortgages and charges, nil. A return of allotments, made up to May 21st, 1936, shows a further £650,000 shares allotted for cash, with 6s. per share called up.

Ellis & Mort, Ltd.—Capital, £20,000 in £1 shares. Return dated October 28th, 1936. 15,000 shares taken up. £10,120 paid. £4,880 considered as paid. Mortgages and charges, nil.

Ellis & Ward, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1. Return dated October 22nd, 1936. 1,000 preference and 6,003 ordinary shares taken up. £1,003 paid on 1,000 preference and 3 ordinary shares. £6,000 considered as paid on 6,000 ordinary shares. Mortgages and charges, nil.

High Vacuum Valve Co., Ltd.—Issue on December 7th, 1936, of £3,000 debentures, part of a series already registered.

Engineering Products, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 19th, 1936, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Wall & Attwooll, Ltd.—Deposit on November 23rd, 1936, of deeds of 25/29, Hyde Park Road, and 36/38, Swan Street, Portsmouth, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

R. J. Raphael & Co., Ltd.—G. C. Moody, of 28a, Basinghall Street, E.C., ceased to act as receiver and/or manager on November 21st, 1936.

Bambairtite Battery Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 20th, 1936. 1,146 shares taken up. £146 paid, £1,000 considered as paid. Mortgages and charges nil.

Star Electric Works (Newcastle), Ltd.—Capital, £500 in 500 shares of £1. Return dated August 22nd, 1936. 101 shares taken up. £101 paid. Mortgages and charges nil.

Tubelight Sales, Ltd.—Capital, £10,000 in £1 shares. Return dated August 6th, 1936. 6,000 shares taken up. £6,000 paid. Mortgages and charges: £3,000.

Electric Resistance Furnace Co., Ltd.—Capital, £5,000 in 5,000 shares of £1. Return dated June 30th, 1936. All shares taken up. £5,000 paid. Mortgages and charges nil.

W. J. Burroughes & Sons, Ltd.—H. A. Esden, of 6, Bishopsgate, E.C.2, ceased to act as receiver and/or manager on November 16th, 1936.

Hellesens, Ltd.—Satisfaction in full on July 17th, 1936, of charge dated May 12th, 1932, and registered May 18th, 1932. (Notice filed December 1st, 1936.) (According to the register of mortgages, the charge registered May 18th, 1932, originally secured all moneys due to bank.)

City Notes

The Ceará Tramway, Light & Power Co., Ltd., held its annual meeting on December 18th, when Mr. E. R. H. Trenow (chairman) said that out of the profit of £19,768 there had to be paid not only debenture interest and amortisation charges, but adequate provision had to be made to meet the depreciation of the assets. When this had been done it was clear that no return was being earned upon the share capital of the company. After reviewing the company's record for the past twenty-five years the chairman said that up to June 30th last the total additional capital expended in extensions was £160,000. The takings had naturally grown considerably, but on paper only. Owing mainly to the depreciation of the milreis the effective earnings of the business had dwindled till they were now only 60 per cent. of what they were ten years ago. No reward had been obtained in respect of the additional capital which was employed. The result of such an anomaly was to make the task of raising capital to meet the growing demand for extension unnecessarily difficult, if not impossible. All schemes of extension were therefore forced to be framed upon the most economical lines possible. The above made it clear that there was a just case for a revision in the company's tariff of charges to make good in some degree the losses occa-

sioned by currency depreciation. Given such revision there was no reason why Ceará should not soon be able to boast of a system of transport and lighting second to none in Brazil.

Companies to be Struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Aurolite Electrical Supplies, Ltd.; Highfield Electrical Co., Ltd.; Mall Radio & Electric, Ltd.; Maybrook Electrical Co., Ltd.; Radio Co. of Great Britain, Ltd.; Wessex Electrical Supplies, Ltd.

Quasi-Arc Co., Ltd.—The entire share capital of this company, which was held by Turner & Newall, Ltd., has been acquired by the British Oxygen Co. The latter company will issue shares in its own capital to Turner & Newall.

The Berlin Power & Light Co. has declared a dividend of Rm.40 per share (less 10 per cent. German tax) for the year ended June 30th last.

The Electrical Apparatus Co., Ltd., reports a profit for the year ended August 31st, after providing for depreciation, of £16,511, to which is added £993 brought in, making £17,504. The preference dividends are paid and £3,000 is placed to reserve, leaving £6,675 to be carried forward. The report states that an offer will be made to repurchase 6 per cent. preference shares of Bray, Markham and Reiss, Ltd., in accordance with the terms on which they were issued in 1928 in satisfaction of dividend arrears. The demand for most of the company's products expanded considerably during the year, and output is now on a scale nearly 50 per cent. greater than twelve months ago.

Telephone Rentals, Ltd., has announced an interim dividend of 4 per cent., less tax (against 3½ per cent.).

Warner's Radio & Electric, Ltd., proposes to issue its recently created capital in the New Year.

The Shawinigan Water & Power Co. is paying a quarterly dividend of 20 cents on the common shares (against 15 cents).

Taxation of Undertakings. By G. V. Harrap

In a previous article (ELEC. REV., *October 30th, page 595*) *the author dealt with the local rates aspect of the taxation of electricity undertakings, outlining the need for a uniform method of assessment. He now discusses the other form of levy, viz., income tax.*

AGITATION by electricity undertakings against income-tax has not been so virulent as that against local rates for the following reasons. The scale of taxation is national instead of parochial and is an unvarying charge upon all undertakings, in contradistinction to the varying pound-

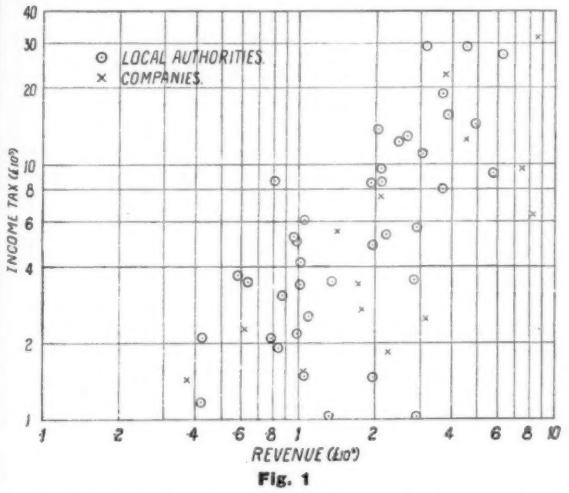


Fig. 1

ages for local rates. Secondly, greater confidence is felt in the assessment for this tax, since the arbitrary allowances and deductions operative in rating valuations (cf. sinking fund, depreciation, &c.) are related to a definitely specified basis. The knowledge that the Commissioners who carry out the assessments are members of one special department, instead of being officials of divers Corporations, and County Urban and Rural District Councils, also creates a more satisfied feeling. Finally, there is no obvious possibility of relief, such as derating, creating an ever-present feeling of injustice.

Basis of Assessment

The general imposition of income-tax is much more modern than local rates, for it first appears in the Income Tax Act, 1799 (39 Geo. 3, c.13), but was abolished between 1815 and 1842. The 1842 Act (5 & 6 Vic. c.35), which virtually re-enacted the 1806 Act (46 Geo. 3, c.65), together with the 1853 Act (16 & 17 Vic. c.34) provided the basis of assessment until the 1910 Act (10 Edw. 7 and 1 Geo. 5, c.8). By 1918 there were fifty-two Acts of Parliament governing the administration of this taxation, and the 1918 Act (8 & 9 Geo. 5, c.40) sought to consolidate this legislation. A consolidating measure cannot alter the existing law, and hence the Act is mainly a reproduction of provisions adapted to the economic and commercial conditions of a century and a quarter ago. By the Finance Act, 1926 (16 & 17 Geo. 5, c.22) concerns enjoying an extraordinary use of land had their basis of assessment changed from Case III of Schedule A to Case I of Schedule D of the 1918 Act, but various Rules of the former Case were retained. Electricity undertakings did not exist in 1842 and 1853, and thus do not appear in the tables appended to these Schedules.

The provisions relating to this class of concern are the well-known ones dealing with incomes from trades, manufactures, professions, &c. Particular rules are prescribed by which the profits of each year are computed. Profits must be computed according to ordinary business methods, so long as no charge is made for capital, personal and irrelevant matters; it is the latter category that often causes trouble.

Depreciation is not allowed as a charge in the accounts, but deductions are made from assessments in respect of wear and tear of plant and machinery. Allowances are also made for obsolescence according to "agreed tables," but no deductions are granted for sinking funds and other allocations from profits, even though these are required to be made under Acts of Parliament. Payments of insurance premiums or compensation for accidents to employés may be charged to the employer's account. The cost of advertisements may only be charged up to the normal amount required from year to year to maintain the business. With the ever-increasing competition experienced by undertakings, and the consequent increase in the amounts expended under this head, this can obviously be a very contentious item.

Expenditure for the alteration of premises may be admitted in those cases in which improvements are not effected. Claims must be submitted for the cost of repairs, it being a fundamental assumption in income-tax law that the property is, and continues to be, of sufficient value to produce the income received. The rent or annual value of premises may, however, be charged as an expenditure item (see Inland Revenue *v.* Scottish Central Electric Power Co., Ltd. (1928), 13 TC.331, p. 335, for determination of annual value in this connection). Credits may be allowed in those cases where deductions cannot

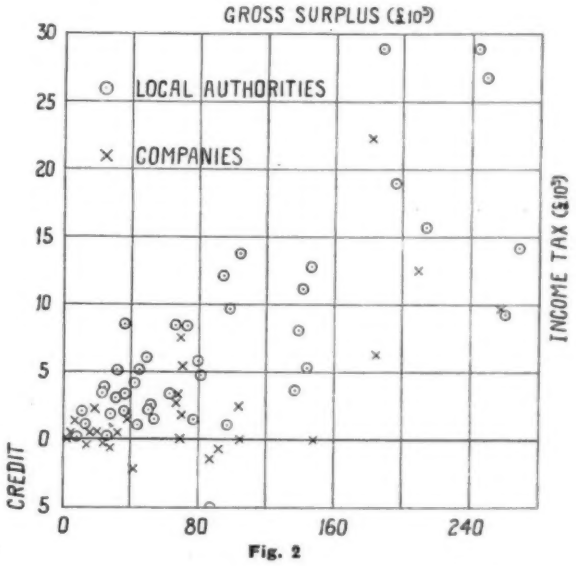


Fig. 2

be computed or agreed to, in time to give them effect in the tax payment of the previous year. For a full exposition of the law and the decided cases, reference should be made to the standard text-book[1].

Incidence of Tax

Income-tax particulars in the Electricity Commissioners' Financial and Engineering Returns suffer from the lateness of publication common to all the statistics, but fortunately the London and Home Counties Joint Electricity Authority pub-

[1]. "Treatise on Income Tax Law," by Judge E. M. Konstam, 6th edition.

lishes details for the undertakings under its jurisdiction. Use has been made of the 1934-35 Return of the J.E.A. to construct the following figures. The income-tax paid by an undertaking has a fortuitous element in it due to the "writing-back" of various items such as contributions to reserves. Considerable fluctuations in the amounts paid from year to year are inevitable, and it would be rash to assume that an undertaking pays the tax shown each year.

To a first approximation it could be said that income-tax should bear some relation to income or revenue; fig. 1 contrasts the tax with total revenue from working. It should be noted that both the abscissæ and ordinate scales are logarithmic, so that an apparently linear relationship is actually hyperbolic on an ordinary scale. Even after making allowance for the proviso in the previous paragraph, it is evident that the incidence of the tax is very uneven. Companies appear to escape more lightly than local authorities, and this is borne out when each successive year is plotted. It might be said

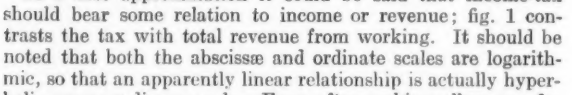


Fig. 3

that the basis of assessment is not the cause of this inequality. But it must be so, for it affects the financial policies of undertakings, since particular distributions of the same revenue, either designed or accidental, will produce varying assessments. The more nearly such items as are included in the statutory deductions approximate to the calculated value for assessment purposes, the less will be the tax. A progressive policy will not necessarily achieve this, for such often induces additional writing down of assets, the full total of which will not be allowed for income-tax purposes.

Since expenditure and various statutory deductions are subtracted from revenue to ascertain the basis of taxation, it might be contended that gross surplus would be a better basis of comparison. The gross value is preferable to the net as it is specifically stated in the Acts that the assessment must be computed before the payment of dividends and other items of indebtedness. Fig. 2, plotted to linear scales in both directions, has been constructed to satisfy this contention. The ordinates have been plotted to show the credits resulting from the above-mentioned method of dealing with the difference between the financial results of the year of payment and the year of assessment. Such credits could obviously not be shown on a hyperbolic scale. The variations in the tax paid are still apparent, but do not appear so inequitable. It would be difficult to say whether the relationship is linear or hyperbolic, but, considering the gradations in the tax rate, it should be a combination of both; especially is this so in view of the progressive rate of increase in surtax.

Comparison with Local Rates

An examination of the statutory provisions regulating the valuation of an undertaking for local rates and its assessment for income-tax will show how many points of similarity there are in the methods used. Both work from the revenue account, subtract somewhat similar allowable items of expenditure, and make deductions in lieu of the actual amounts expended upon depreciation, wear and tear of machinery, &c. A comparison between the amounts paid under these two heads would be both interesting and instructive. Better still would be income-tax *v.* rateable value; the former is a standard non-varying tax, but local rates are paid at varying rate-poundages. The use of rateable value eliminates this variable quantity, and fig. 3 has been constructed on this basis and is of a similar type to fig. 2. From a mean of the curve (such as it is) the figures bear out the similarity exhibited in the two bases of assessment, *i.e.*, a linear relationship such that rateable value = 3 income-tax.

Conclusion

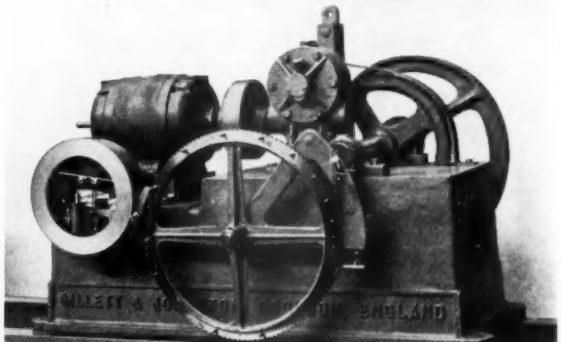
The particulars given in this article, together with those given in my previous article on local rates, show that the burden of both kinds of taxation is heavy and its incidence is unequal. I feel that research into the effects of taxation upon electricity undertakings would amply repay time and labour; greater study of its incidence would be of considerable value to the industry.

Parliamentary control is an essential feature of both these forms of taxation, hence the mitigation of the burden and its incidence appears to be attainable only by legislative action. The Income-Tax Codification Committee in its report, Clause 217, states: "Electricity undertakings may be said to be of a like nature to gasworks, and the Board have frequently been approached by electricity undertakers with the suggestion that they should be assessed under No. III of Schedule A. We have therefore extended the clause (in the draft Bill) so as specifically to include tramways and electricity works." If this were given statutory force it might provide some relief to the industry.

An Electric Tower Clock

THE large electrical clock in the tower of the new Luton Town Hall is somewhat unusual. It has four 10-ft. dials and a seconds pendulum master-clock forms the main time-keeper which controls the timepiece operating the dials and the chiming and striking units. The timepiece unit is a weight-driven mechanism of simple form. The wheels are reduced to three, and the release mechanism consists of four arms attached to a central bush mounted on the worm spindle. The tips of these arms engage one by one with an electro-magnetic trigger which releases them at the correct moment under the control of impulses from the master clock. The train is held at rest until a half-minute impulse from the master clock causes the magnet to trip the trigger. The driving weight is arranged for automatic re-winding by an electric motor. Interposed between the driven sprocket and the barrel is an epicyclic gear train which maintains power and prevents the timepiece from ceasing to move forward while being re-wound. The same action takes place if the clock is hand wound. The electro-magnet is arranged in a quick-release circular housing which permits of its rapid removal and replacement in the event of failure.

At night time the dials are illuminated by tubing of the "white-neon" type, slip-rings mounted on insulators being applied to the motion work in order to conduct the high-voltage supply to the tubes mounted on the hands. Each dial motion work is a self-contained unit, the tubes forming the hand spindles being enclosed where they pass through the walls and out to the dial centres. The result is a very neat weather-proof assembly. The placing of the 12 to 1 ratio gears for the hands necessitated careful design, for, as earth return is employed for the tubing illuminating the dials, the wheels had to be well spaced from the slip rings and brush gear. To sound the hours and quarters simple motor-driven mechanisms are started up at the required times by the master clock, and operate their own cut-out switches at the conclusion of the sounding. The clock is silenced at night, a 24-hour wheel, operated by a standard impulse-dial mechanism, opening and



The hour-chiming unit of the Luton Town Hall clock

closing contacts in the low-voltage circuit between master clock and chiming and striking units at the correct times. Our thanks are due to Mr. J. W. Tomlinson, borough engineer of Luton. The makers were Gillett & Johnston, Ltd., and the illuminating tubing was supplied by Boro' Electric Signs.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1935

5175. "Current-control apparatus for reversing electric motors." E. Struckman and H. J. Norballe. Feb. 18th, 1935. (457193.)

10436. "Electrical fittings." C. G. Lange. May 4th, 1936. (457446.)

11850. "Microphones." N. H. Rose and M. E. Angel. April 17th, 1936. (457195.)

15165. "Television receivers." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. May 24th, 1935. (457274.)

15168. "Earth-switch arrangements." Marconi's Wireless Telegraph Co., Ltd., and A. W. Whistlecroft. May 24th, 1935. (457275.)

15169. "Thermionic valve circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and D. F. George. May 24th, 1935. (457276.)

15210. "Electric communication cables." Standard Telephones & Cables, Ltd., W. K. Weston, and D. Nunn. May 24th, 1935. (457280.)

15263. "Tone-control devices for radio receivers." Coutts & Co., and F. Johnson (Legal representatives of J. Y. Johnson, decd.) (Philco Radio & Television Corporation.) May 25th, 1935. (457452.)

15318. "Dynamo regulators." C. A. V.-Bosch, Ltd., and W. H. Glaser. May 25th, 1935. (457337.)

15436. "Methods of controlling the speed of alternating-current motors." British Thomson-Houston Co., Ltd., B. Adkins and J. H. Walker. May 27th, 1935. (457460.)

15510. "Antenna systems and feeding arrangements therefor." Standard Telephones & Cables, Ltd., and C. E. Strong. May 28th, 1935. (457468.)

15632. "Oil-immersed circuit-breakers." A. West & Co., Ltd., and V. Breeze. May 29th, 1935. (457395.)

15701. "Electricity meters." V. Hope. May 30th, 1935. (457204.)

15751. "Radio receiving systems." Kolster-Brandes, Ltd., and C. W. Earp. May 30th, 1935. (457485.)

15757. "Electric-discharge lamps." General Electric Co., Ltd., and H. G. Jenkins. May 30th, 1935. (Cognate application 32887/35.) (457486.)

15814. "Circuit systems with one or more discharge tubes and discharge tubes for use in such systems." C. A. Schleimann-Jensen. July 6th, 1934. (457340.)

15816. "Electron-discharge apparatus, for use in television, for example. H. G. Lubszynski and J. E. Keyston. May 30th, 1935. (457493.)

15929. "Piezo-electric crystals." Marconi's Wireless Telegraph Co., Ltd. (S. A. Bokovoy and C. F. Baldwin). May 31st, 1935. (457342.)

15932. "Electro-magnetic light current relays." Standard Telephones & Cables, Ltd., and R. St. G. Terry. May 31st, 1935. (457540.)

16110. "Attachment bracket for wireless and like electrical components." Stratton & Co., Ltd., and G. S. Laughton. June 4th, 1935. (457497.)

16286. "Electrical plug-and-socket connections." C. H. Parsons, Ltd., and G. B. Handley. June 5th, 1935. (457346.)

16501. "Cathode-ray tubes for television transmission, such as iconoscopes." J. D. McGee, G. S. P. Freeman and W. S. Brown. June 6th, 1935. (457531.)

16603. "Thermionic valve circuits for differentiating between signals of different amplitude." Murphy Radio, Ltd., K. S. Davies and H. F. W. J. Freundlich. June 7th, 1935. (457532.)

17288. "Electric coupling." E. W. Bonson. June 15th, 1935. (457502.)

17908. "Electric connectors containing a thermal switch." R. E. Ollerenshaw. June 21st, 1935. (457505.)

18346. "Tuning controls for wireless receivers." W. J. Brown and E. C. Wadlow. June 26th, 1935. (457207.)

18631. "Multi-range superheterodyne receiver." E. K. Cole, Ltd., and H. C. Rowe. June 29th, 1935. (457398.)

19277. "Television receiving sets." General Electric Co., Ltd., N. R. Campbell and L. C. Jesty. July 25th, 1935. (Cognate application 36084/35.) (457510.)

19445. "Enclosed electric switchgear with interlocked covers." General Electric Co., Ltd., and S. W. Richards. July 8th, 1935. (Cognate application 9808/36). (457209.)

19504. "Conduits for electric wires." M. A. L. Du Prey. July 7th, 1934. (457210.)

19737. "Arrangements for forming electric conductors." Siemens Bros. & Co., Ltd., and E. R. Hubbard. July 10th, 1935. (457514.)

22481. "Telephone circuits." General Electric Co., Ltd., and A. F. Jones. Aug. 9th, 1935. (457215.)

22848. "Remote control for radio receivers." E. K. Cole, Ltd., and R. I. Cowley. Aug. 14th, 1935. (457217.)

22946. "Electric-discharge tubes." Ferranti, Ltd., and S. Evison. Aug. 15th, 1935. (457221.)

25429. "Electric meters." Measurement, Ltd., R. Connor and C. F. Clifford. Sept. 13th, 1935. (457408.)

26039. "Electrical plug-and-socket couplings." Wandsworth Electrical Manufacturing Co., Ltd., and T. Batchelor. Sept. 20th, 1935. (457224.)

26127. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) Sept. 20th, 1935. (457410.)

27080. "Means for controlling automatic Diesel electric generators and other similar combined sets." Kyte Engineering & Motor Co., Ltd., and A. Read. Oct. 1st, 1935. (457413.)

29279. "Short-time meters, particularly suitable for echo-sounding devices." Siemens Apparate und Maschinen Ges. Nov. 8th, 1934. (457415.)

30263. "Electric regulating systems." British Thomson-Houston Co., Ltd. Nov. 1st, 1934. (457360.)

31682. "Television receiving systems." C. Lorenz Akt.-Ges. July 3rd, 1935. (Cognate application 31683/35). (457417.)

1936

480. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. Jan. 7th, 1935. (457234.)

2995. "Electric filters." Siemens & Halske Akt.-Ges. Feb. 27th, 1935. (457236.)

3752. "Insulators for carrying H.F. coils with iron cores." E. Michaelis. Feb. 11th, 1935. (457239.)

3896. "Electric circuit-breakers." Allmanna Svenska Elektriska Aktiebolaget. Feb. 8th, 1935. (457427.)

5136. "Regulation of internal-combustion engine electric power units for vehicles." Sulzer Frères Soc. Anon. July 8th, 1935. (Addition to 379882.) (457366.)

5671. "Method of applying fluorescent material to a support." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 28th, 1935. (457244.)

7529. "Supply arrangements for welding apparatus." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 13th, 1935. (Cognate application 7530/36.) (457367.)

10113. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 27th, 1935. (457253.)

10217. "Rheostat." Singer Manufacturing Co. August 13th, 1935. (457254.)

10758. "Photo-electric sound-reproduction processes and apparatus therefor." Internationale Tobis Maatschappij N.V. April 11th, 1935. (457434.)

11498. "Electric-discharge lamps." British Thomson-Houston Co., Ltd. April 23rd, 1935. (457371.)

13111. "Resistance welding machines." Allgemeine Elektricitäts-Ges. May 16th, 1935. (457257.)

13344. "Dimming devices for stage electric lighting regulation." Siemens-Schuckertwerke Akt.-Ges. August 27th, 1935. (457439.)

13777. "Change-over switch, particularly for the changing over of high-frequency coils for radio sets." G. Langlotz. May 15th, 1936. (457259.)

14204. "Electric-discharge devices." British Thomson-Houston Co., Ltd. May 20th, 1935. (457378.)

16565. "Methods for the manufacture of luminous electric-discharge containers with fluorescence." W. J. Tennant. (Soc. anon. pour les Applications de l'Electricité et des Gaz Rares Etablissements Claude-Paz & Silva.) June 15th, 1936. (457317.)

17551. "Multiple inductance coils for tuning oscillatory circuits." R. Bosch Akt.-Ges. June 24th, 1935. (457263.)

19762. "Electric torches." Elektrotechnische Fabrik Schmidt & Co. Ges. July 16th, 1935. (Cognate application 19763/36.) (457264.)

20416. "Mercury switches." A. F. Burgess (Adlake Co.). July 23rd, 1935. (457529.)

20442. "Vapour-containing electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 23rd, 1935. (457266.)

22621. "Electric switches of the gas-blast type." British Thomson-Houston Co., Ltd. August 19th, 1935. (457442.)

23361. "Installations for the parallel working of a number of high-frequency induction furnaces." Siemens & Halske Akt.-Ges. September 4th, 1935. (457381.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 16th :—

Westinghouse. No. 570654. Class 6. Refrigerating machines. —The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., U.S.A. (British representative, G. Raymond Shepherd, 2, Norfolk Street, Strand, W.C.2).

Sternette. No. 572299. Sternette Universal No. 572734. Class 6. Refrigerating machines.—L. Sterne & Co., Ltd., 1, Upper Thames Street. E.C.4.

Lumastat. No. 572575. Class 8. An electrical apparatus for automatically controlling oil burners.—G. C. Pillinger & Co., Ltd., 216, Sutton Common Road, Sutton, Surrey.

New Electricity Showrooms and Offices

THE North-Eastern Electric Supply Co., Ltd., has opened new premises at Ashington. They consist of a showroom on the ground floor and offices and staff accommodation on the first floor. There is also a demonstration theatre to seat forty people. The opening ceremony was performed by Mr. J. G. Mordue, chairman of the Ashington Urban District Council, and at luncheon Mr. Mordue was presented by Mr. W. F. T. Pinkney, engineer to the company, with an electric coffee percolator and an inscribed tray.

New showrooms and offices were opened by the Bury Corporation in the old Town Hall, Bury, last week. The main showroom is panelled to a height of 9 ft. in Italian walnut. Special lighting arrangements give various colour effects, and there is a demonstration and lecture room capable of seating sixty-five people. On the front of the building is a projecting canopy incorporating neon signs and floodlights. Alderman T. Evans, chairman of the Electricity Committee, in opening the showrooms said that, in 1897, 12,000 kWh of electricity was consumed in the borough, while the output of the Department last year was over 30 million kWh.

New Municipal Offices

The erection of a new building will shortly be undertaken on the site of the old electricity generating station in Jubilee Street, Blackburn, to house the management, engineering and clerical staffs of the Corporation electricity undertaking. Designed on modern horizontal lines, the building will have elevations in brick faced with stone dressings, and there will be a flat roof of reinforced concrete. Mr. R. H. Harral, engineer and manager, states that the scheme provides for a three-storey building and there will be facilities for extension.